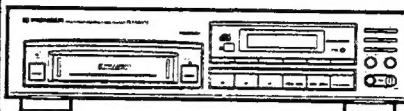


Service Manual

PIONEER®
The Art of Entertainment



ORDER NO.
ARP2694

MULTI-PLAY COMPACT DISC PLAYER

PD-M602

PD-M552

PD-M502

PD-M602, PD-M552 AND PD-M502 HAVE THE FOLLOWING:

Type	Model			Power Requirement	Remarks
	PD-M602	PD-M552	PD-M502		
KU	○	○	○	AC120V only	
KUXJ	○	○	○	AC120V only	
KUXJS	○	○	○	AC120V only	
KC	○	—	○	AC120V only	
KCXJ	○	—	○	AC120V only	

- This manual is applicable to the following : PD-M602/KU, KUXJ, KUXJS, KC and KCXJ ; PD-M552/KU, KUXJ, and KUXJS ; PD-M502/KU, KUXJ, KUXJS, KC and KCXJ.
- For the following : PD-M602/KUXJ, KUXJS, KC and KCXJ ; PD-M552/KU, KUXJ, and KUXJS ; PD-M502/KU, KUXJ, KUXJS, KC and KCXJ, refer to page 38.

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PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan

PIONEER ELECTRONICS SERVICE INC. P.O. Box 1760, Long Beach, California 90801 U.S.A.

PIONEER ELECTRONICS OF CANADA, INC. 300 Allstate Parkway Markham, Ontario L3R 0P2 Canada

PIONEER ELECTRONIC [EUROPE] N.V. Haven 1087 Keetberglaan 1, 9120 Melsele, Belgium

PIONEER ELECTRONICS AUSTRALIA PTY. LTD. 178-184 Boundary Road, Braeside, Victoria 3195, Australia TEL: [03] 580-9911

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SF FEB. 1993 Printed in Japan

1. SAFETY INFORMATION

This service manual is intended for qualified service technicians; it is not meant for the casual do-it-yourselfer. Qualified technicians have the necessary test equipment and tools, and have been trained to properly and safely repair complex products such as those covered by this manual. Improperly performed repairs can adversely affect the safety and reliability of the product and may void the warranty. If you are not qualified to perform the repair of this product properly and safely, you should not risk trying to do so and refer the repair to a qualified service technician.



WARNING

Lead in solder used in this product is listed by the California Health and Welfare agency as a known reproductive toxicant which may cause birth defects or other reproductive harm (California Health & Safety Code, Section 25249.5).

When servicing or handling circuit boards and other components which contain lead in solder, avoid unprotected skin contact with the solder. Also, when soldering do not inhale any smoke or fumes produced.



NOTICE

(FOR CANADIAN MODEL ONLY)

Fuse symbols  (fast operating fuse) and/or  (slow operating fuse) on PCB indicate that replacement parts must be of identical designation.

REMARQUE

(POUR MODÈLE CANADIEN SEULEMENT)

Les symboles de fusible  (fusible de type rapide) et/ou  (fusible de type lent) sur CCI indiquent que les pièces de remplacement doivent avoir la même désignation.

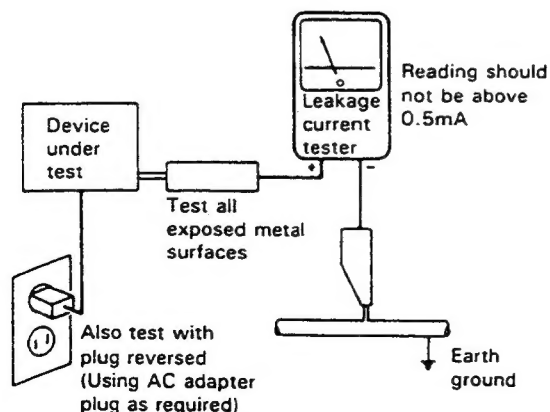
(FOR USA MODEL ONLY)

1. SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester such as Simpson Model 229-2 or equivalent between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed 0.5mA.



AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

2. PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in the appliance have special safety related characteristics. These are often not evident from visual inspection nor the protection afforded by them necessarily can be obtained by using replacement components rated for voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Service Manual.

Electrical components having such features are identified by marking with a Δ on the schematics and on the parts list in this Service Manual.

The use of a substitute replacement component which does not have the same safety characteristics as the PIONEER recommended replacement one, shown in the parts list in this Service Manual, may create shock, fire, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult the current PIONEER Service Manual. A subscription to, or additional copies of, PIONEER Service Manual may be obtained at a nominal charge from PIONEER.

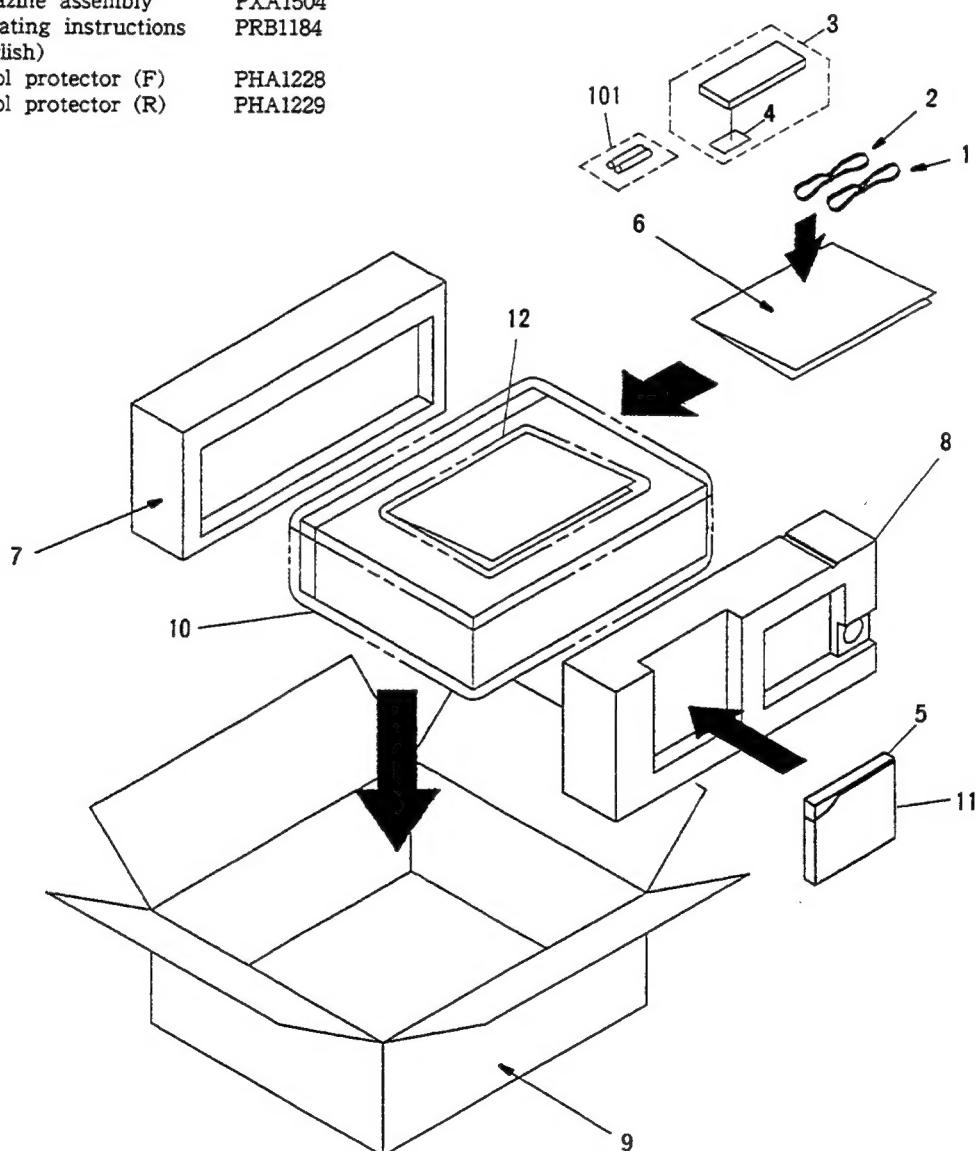
2. PACKING AND PARTS LIST

NOTES:

- Parts marked by "NSP" are generally unavailable because they are not in our Master Spare Parts List.
- The \triangle mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- Parts marked by "⊙" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.

Parts List

Mark	No.	Description	Part No.	Mark	No.	Description	Part No.
	1	Connection cord with mini plug (for SR cord)	PDE - 319		9	CD packing case	PHG1869
	2	Connection cord with pin plug (for Audio)	PDE1109		10	Mirror mat sheet	Z23 - 007
	3	Remote control unit	PWW1068		11	PP case	PYY1169
	4	Battery cover	PZN1010		12	Bag	Z21 - 038
	5	Magazine assembly	PXA1504	NSP	101	Dry cell battery (R03, AAA)	VEM - 022
	6	Operating instructions (English)	PRB1184				
	7	Styrol protector (F)	PHA1228				
	8	Styrol protector (R)	PHA1229				



3. EXPLODED VIEWS AND PARTS LIST

NOTES:

- Parts marked by "NSP" are generally unavailable because they are not in our Master Spare Parts List.
- The \triangle mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- Parts marked by "☉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.

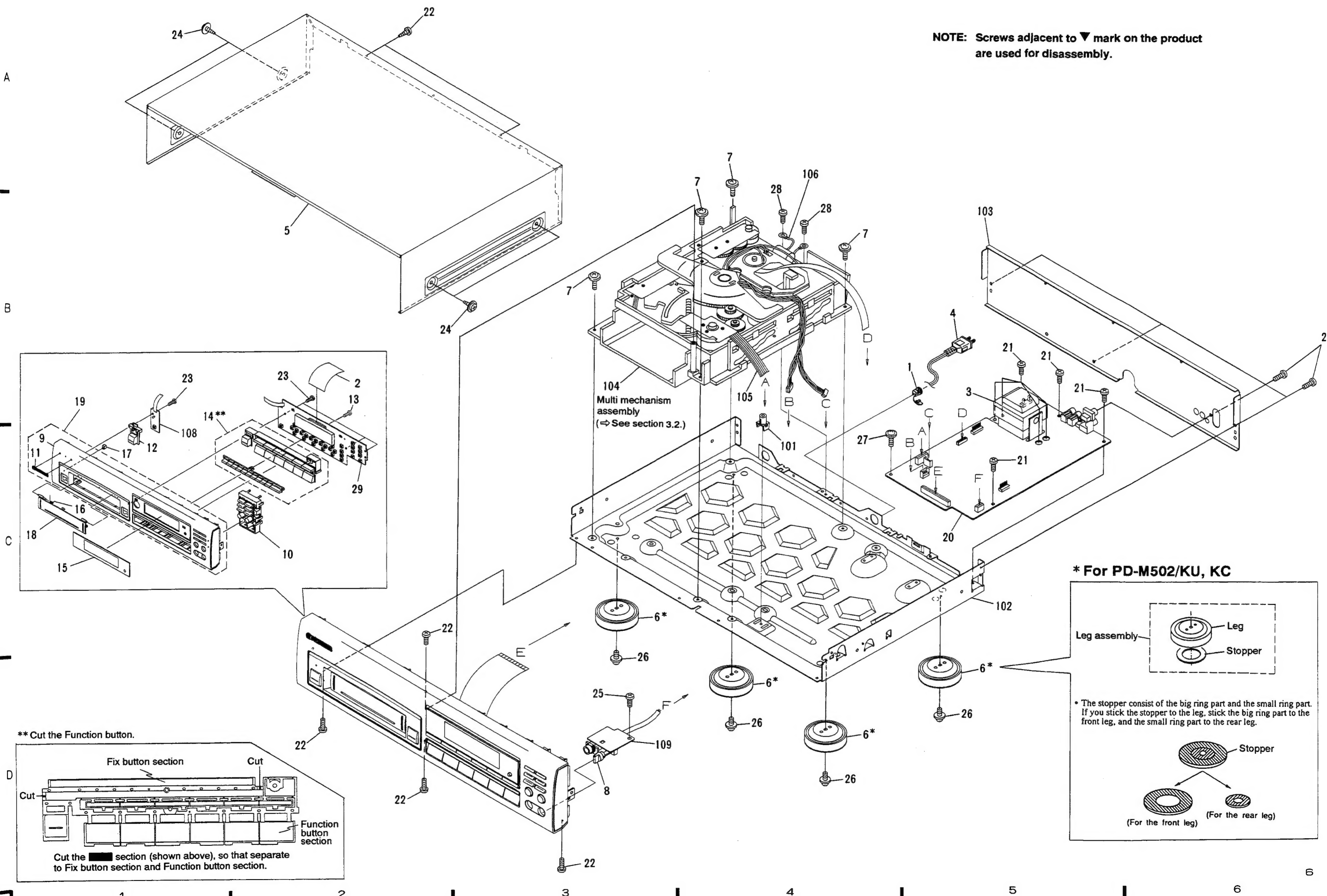
3.1 EXTERIOR

Parts List

Mark	No.	Description	Part No.	Mark	No.	Description	Part No.
\triangle	1	Strain relief	CM - 22C	NSP	101	PCB mould	AMR1525
	2	32P F.F.C./30V	PDD1125	NSP	102	Under base	PNA1751
\triangle	3	Power transformer	PTT1237	NSP	103	Rear base	PNA1915
\triangle	4	Power cord with plug	PDG1015	NSP	104	Multi mechanism assembly	PXA1469
	5	Bonnet	PYY1149	NSP	105	Flat cable (6P)	D20PYY0615E
	6	Insulator	PNW1912	NSP	106	Earth lead unit	XDF - 502
	7	Screw	IBZ30P080FCC		107	.....
	8	Knob (Headphone)	PAC1707	NSP	108	Switch board assembly	PWZ2520
	9	Function panel	PNW2250	NSP	109	Headphone board assembly	PWZ2524
	10	Mode button	PAC1709				
	11	Name plate	PAM1608				
	12	Power button	PAC1719				
	13	Screw	BBZ26P120FZK				
	14	Function button	PAC1717				
	15	Display window	PAM1607				
	16	Spring (Door)	PBH1022				
	17	LED lens	PNW2019				
	18	Door	PNW2264				
	19	Function panel assembly	PEA1265				
	20	Mother board assembly	PWM1746				
	21	Screw	BBZ30P060FMC				
	22	Screw	BBZ30P080FZK				
	23	Screw	PPZ30P120FMC				
	24	Screw	FBT40P080FZK				
	25	Screw	IBZ30P060FCC				
	26	Screw	IBZ30P100FCC				
	27	Screw	IBZ30P180FMC				
	28	Screw	PDZ30P050FMC				
	29	Function board assembly	PWZ2516				

Exterior

NOTE: Screws adjacent to ▼ mark on the product are used for disassembly.



*** For PD-M502/KU, KC**

Leg assembly

Leg

Stopper

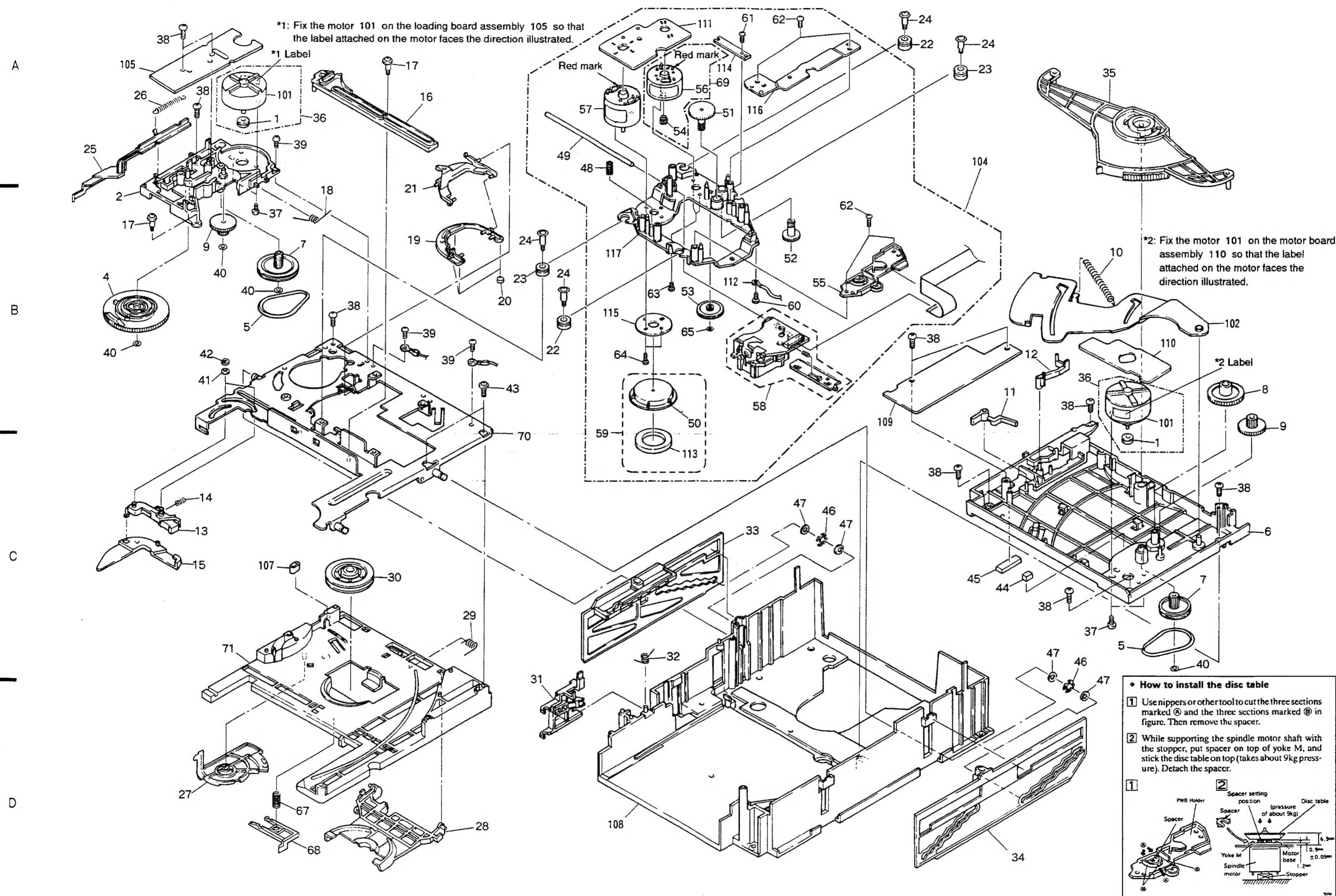
• The stopper consist of the big ring part and the small ring part. If you stick the stopper to the leg, stick the big ring part to the front leg, and the small ring part to the rear leg.

Stopper

(For the front leg)

(For the rear leg)

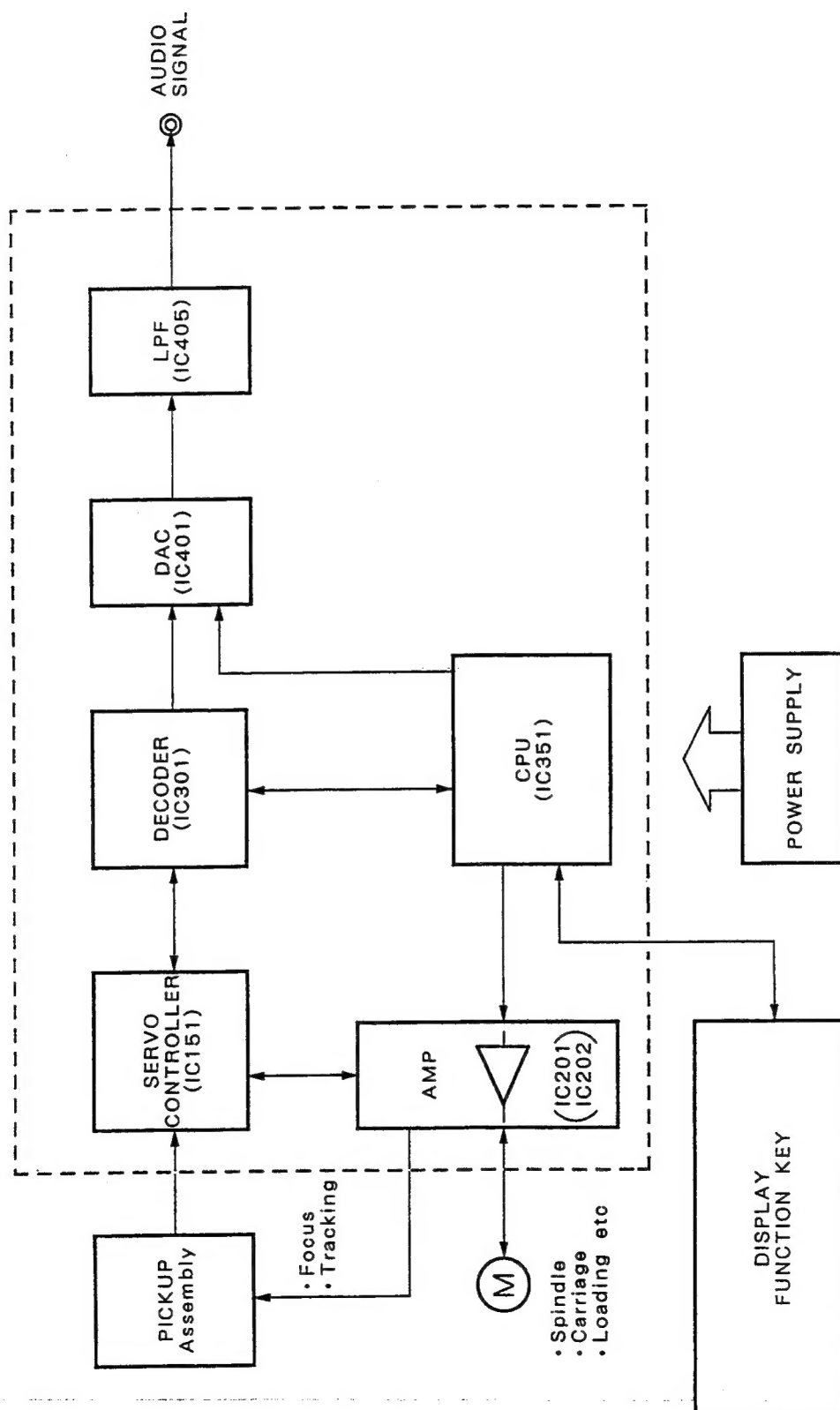
3.2 MULTI MECHANISM ASSEMBLY



Parts List

Mark	No.	Description	Part No.	Mark	No.	Description	Part No.
	1	Motor pulley	PNW1634		49	Guide bar	PLA1094
	2	Gear holder	PNW1929		50	Disc table	PNW1067
	3	• • • • •			51	Gear 1	PNW2052
	4	Cam gear	PNW1923		52	Gear 2	PNW2053
	5	Belt	PEB1138		53	Gear 3	PNW2054
	6	Top guide	PNW2061		54	Pinion gear	PNW2055
	7	Gear pulley	PNW1918		55	PWB holder	PNW2057
	8	Gear S	PNW1919		56	Carriage DC motor / 0.3W	PXM1027
	9	Gear L	PNW1920		57	D.C. motor assembly (spindle, with oil)	PEA1235
	10	Eject spring	PBH1107				
	11	Switch lever	PNW1927		58	Pickup assembly	PEA1285
	12	Seven bar	PNW1931		59	Disc table assembly	PEA1035
	13	Sub rotary lever	PNW1933		60	Screw	BBZ26P060FMC
	14	Sub rotary lever spring	PBH1111		61	Screw	BPZ20P060FMC
	15	Rotary lever	PNW1932		62	Screw	BPZ26P100FMC
	16	Drive plate	PNW1930		63	Screw	JFZ17P025FZK
	17	Motor screw	PBA-112		64	Screw	JFZ20P040FMC
	18	Holder lever spring	PBH1110		65	Washer	WT12D032D025
	19	Disc holder	PNW1924		66	• • • • •	
	20	Cushion A	PED1001		67	Stopper spring	PBH1131
	21	Holder lever	PNW1925		68	Stopper	PNW2069
	22	Float rubber	PEB1014		69	D.C. motor assembly (CARRIAGE)	PEA1246
	23	Float rubber	PEB1132				
	24	Float screw	PBA1073		70	Upper chassis	PNB1267
	25	Release lever	PNW1934		71	Sub chassis	PNW2073
	26	Release spring	PBH1106				
	27	Clamper cam	PNW1922				
	28	Clamper holder	PNW1921				
	29	Clamper spring	PBH1109				
	30	Clamper	PNW1857	NSP	101	Motor	VXM1033
				NSP	102	Eject lever	PNB1306
	31	Lock lever	PNW1917		103	• • • • •	
	32	Lock spring	PBH1108	NSP	104	Servo mechanism assembly M	PXA1417
	33	Stair L	PNW1915				
	34	Stair R	PNW1916				
	35	Synchronize lever	PNW1926	NSP	105	Loading board assembly	PWZ2038
					106	• • • • •	
	36	Motor assembly (LOADING, DISC SELECT)	PEA1130	NSP	107	Rubber tube	PEB1171
	37	Screw	PMZ26P040FMC	NSP	108	Main chassis	PNW2074
	38	Screw	PPZ30P080FMC	NSP	109	Select board assembly	PWZ2533
	39	Screw	BBZ30P060FMC	NSP	110	Motor board assembly	PWZ2040
	40	Washer	WT26D047D025	NSP	111	Mechanism board assembly	PWX1192
	41	Washer	WA31D054D025	NSP	112	Earth lead unit	PDF1074
	42	E ring	Z39-010	NSP	113	Clamp magnet	PMF1014
	43	Screw	IPZ30P080FMC	NSP	114	Gear stopper	PNB1303
	44	Rubber spacer	PEB1238	NSP	115	Yoke M	PNB1312
	45	Rubber spacer	PEB1179	NSP	116	AV angle	PNB1405
	46	Silent ring	PBK1093	NSP	117	Carriage base	PNW2058
	47	Washer	WA62D130D025				
	48	Earth spring	PBH1132				

4. BLOCK DIAGRAM



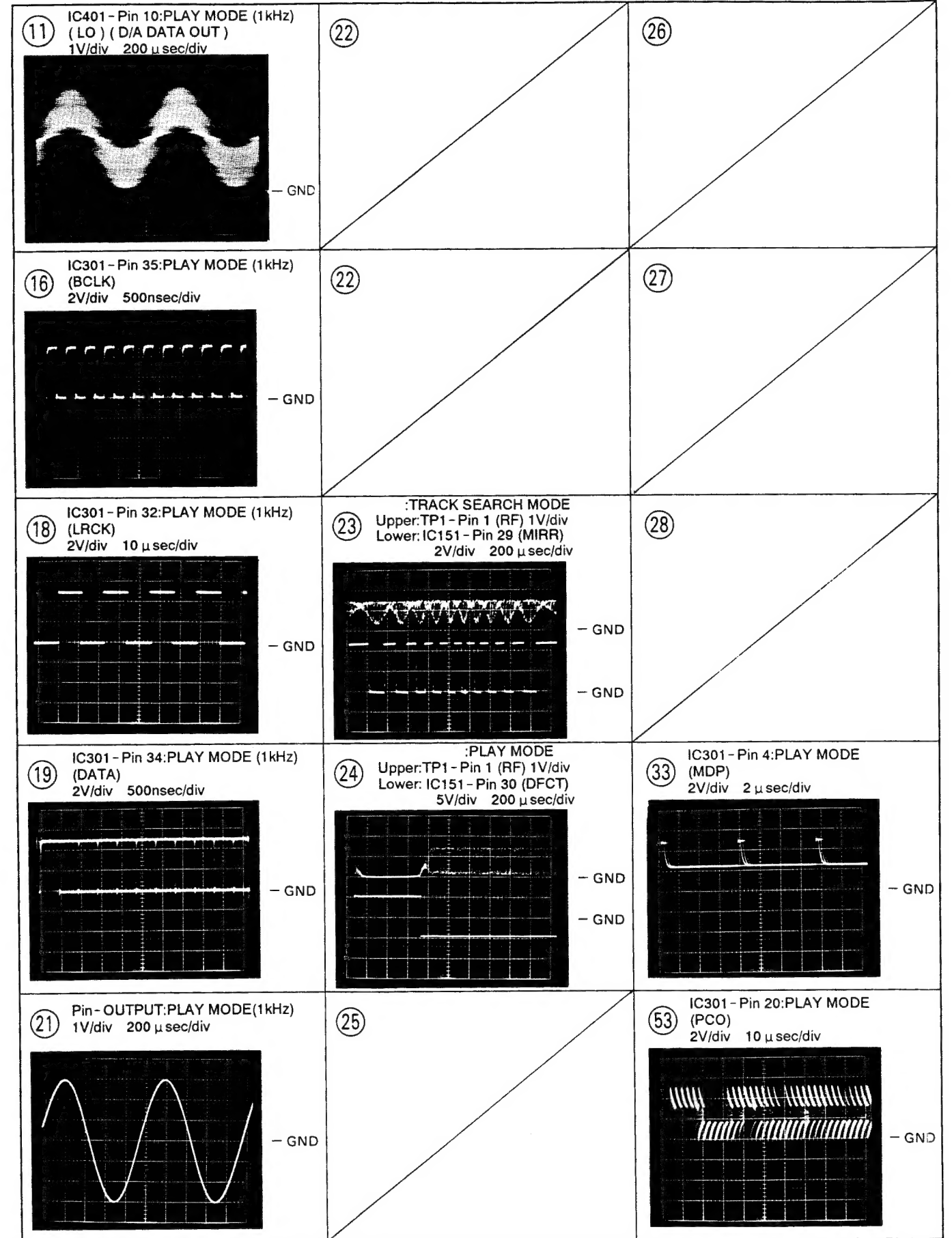
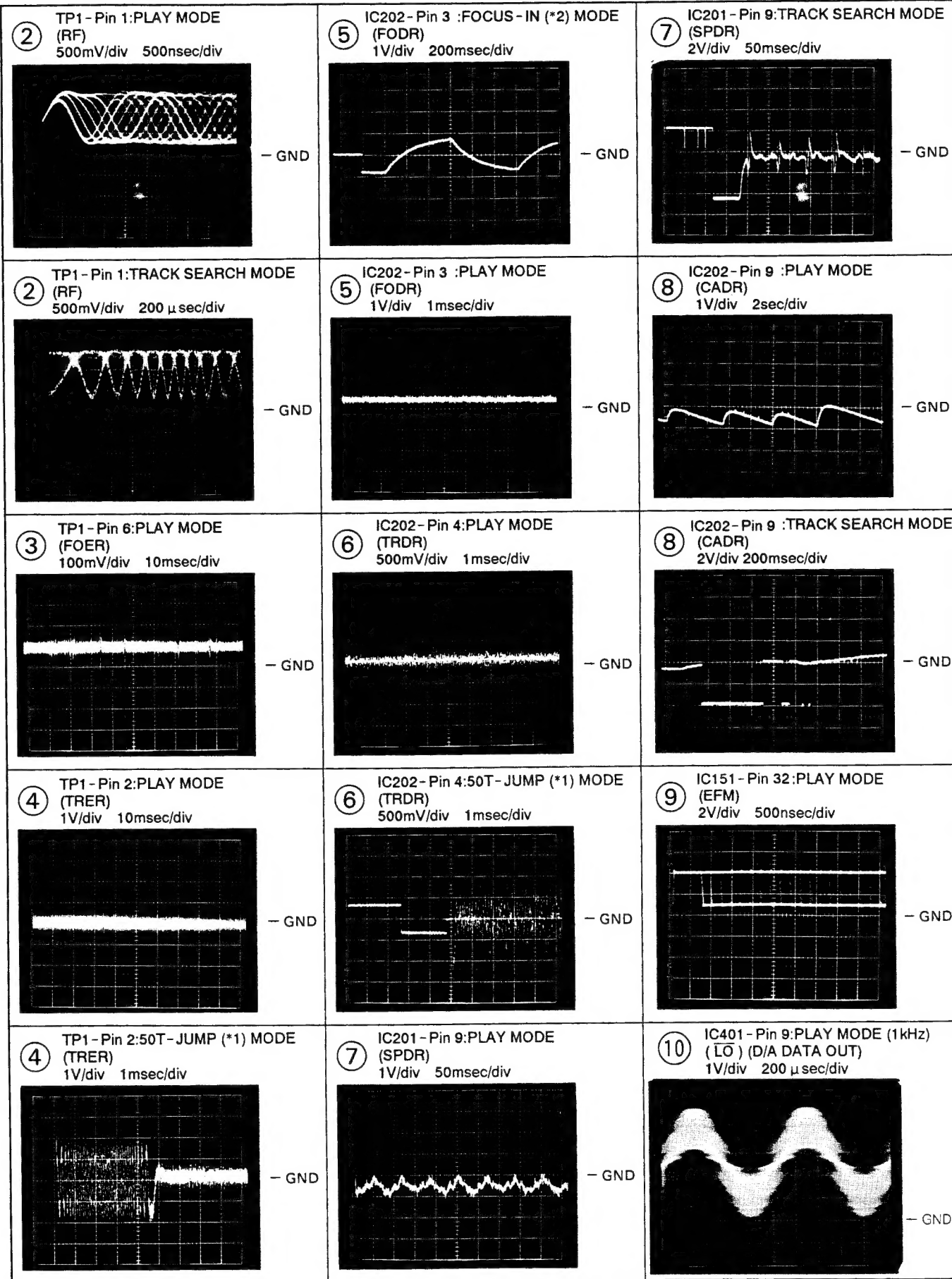
5. SCHEMATIC DIAGRAM

5.1 Waveforms

Note: The encircled numbers denote measuring points in the schematic diagram.

*1 50T-JUMP: After switching to the pause mode, press the manual search key.

*2 FOCUS-IN: Press the key without loading a disc.



Note:

1. When on "PARTS PARTS L

2. Since the values of ment.

3. RESISTOR
Unit: k: kΩ
Rated pow
noted.
Tolerance:
less other

4. CAPACIT
Unit: p: pF
Ratings: c
Rated volt

5. COILS:
Unit: m: m

6. VOLTAGE
: DO
mA or

7. OTHERS:

• : Sig
• : Ad
• (Red)
• The i. m
portanc
placing.

8. SWITCHE

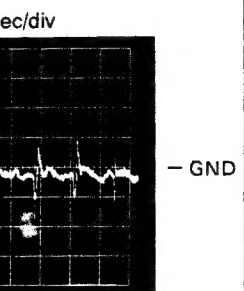
FUNCTION

S702
S703
S704
S705
S706
S708
S721
S722
S723
S724
S725
S726
S727
S728
S729
S730
S731
S732
S733
S734
S735
S736
SWITCH
S801

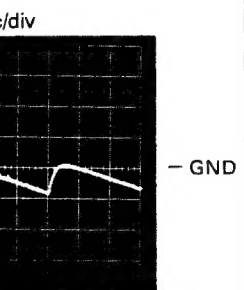
the pause mode, press the

at loading a disc.

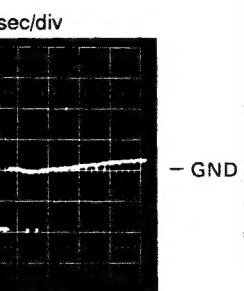
TRACK SEARCH MODE



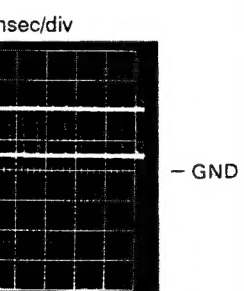
PLAY MODE



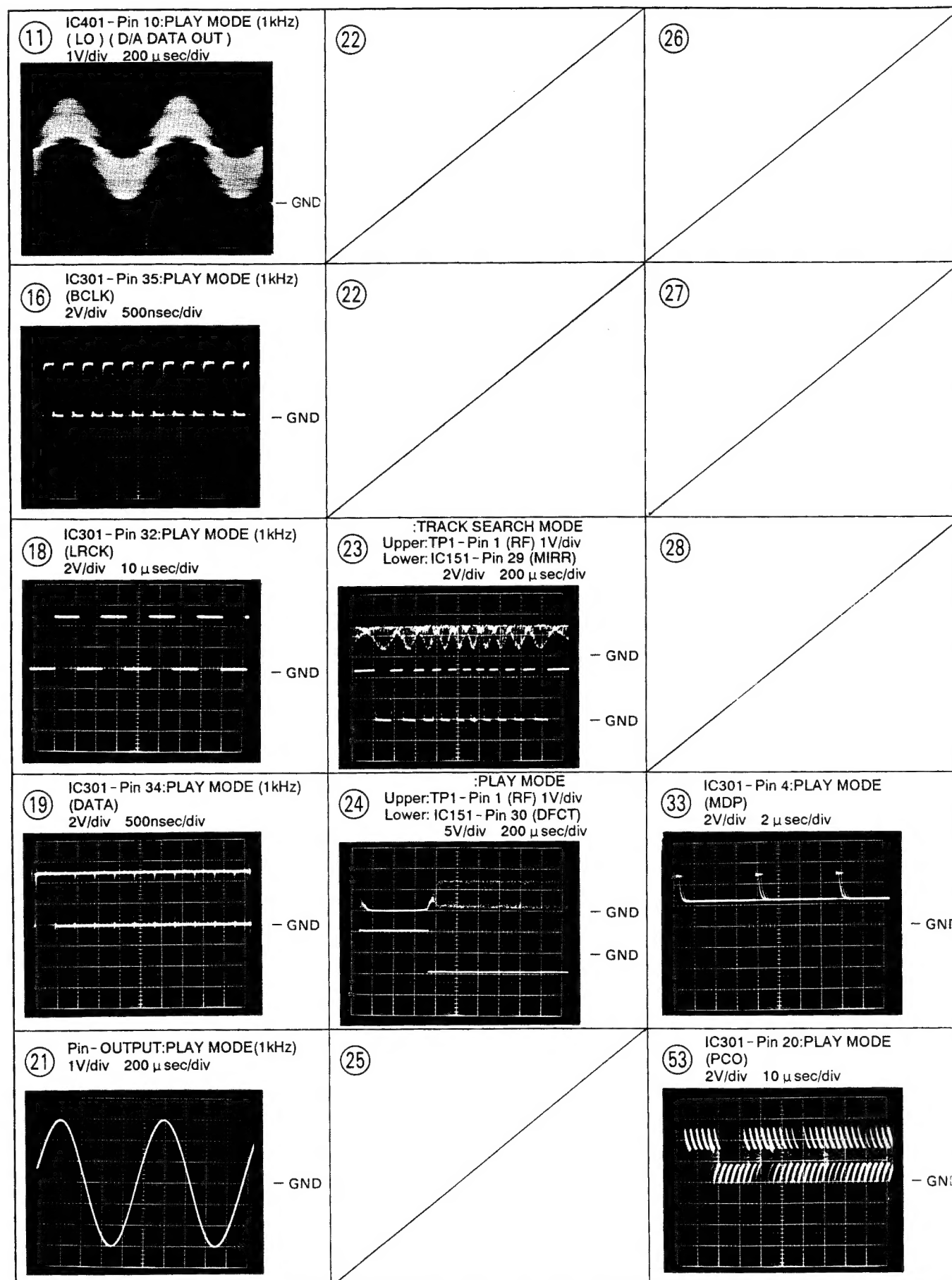
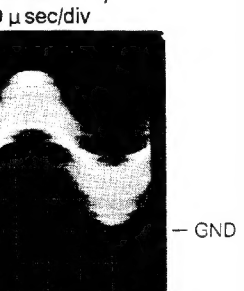
TRACK SEARCH MODE



2:PLAY MODE



9:PLAY MODE (1kHz)
DATA OUT)



Note:

(Type 4)

1. When ordering service parts, be sure to refer to "PARTS LIST of EXPLODED VIEWS" or "PCB PARTS LIST".

2. Since these are basic circuits, some parts of them or the values of some components may be changed for improvement.

3. RESISTORS:
Unit: k: kΩ, M: MΩ, or Ω unless otherwise noted.
Rated power: 1/4W, 1/6W, 1/8W, 1/10W unless otherwise noted.
Tolerance: (F): ±1%, (G): ±2%, (K): ±10%, (M): ±20% or ±5% unless otherwise noted.

4. CAPACITORS:
Unit: p: pF or μF unless otherwise noted.
Ratings: capacitor (μF)/ voltage (V) unless otherwise noted.
Rated voltage: 50V except for electrolytic capacitors.

5. COILS:
Unit: m: mH or μH unless otherwise noted.

6. VOLTAGE AND CURRENT:
□ : DC voltage (V) in PLAY mode unless otherwise noted.
⊗ mA or - mA : DC current in PLAY mode unless otherwise noted.
Value in () is DC current in STOP mode.

7. OTHERS:
• → : Signal route.
• ⊗ : Adjusting point.
• ▼ (Red) : Measurement point.
• The mark found on some component parts indicates the importance of the safety factor of the parts. Therefore, when replacing, be sure to use parts of identical designation.

8. SWITCHES (Underline indicates switch position):

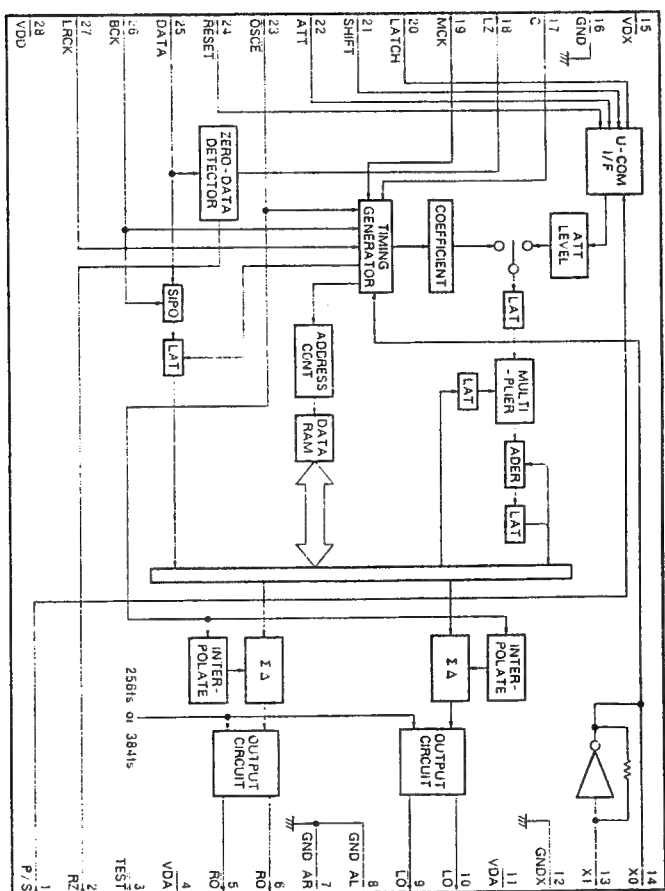
FUNCTION BOARD ASSEMBLY

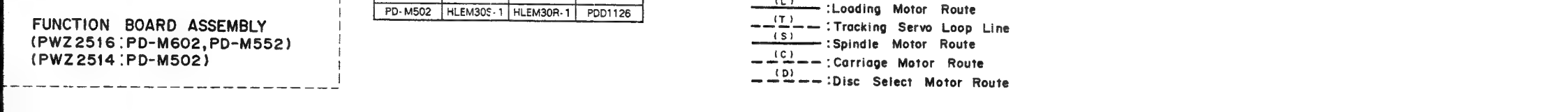
S702 : EJECT ▲
S703 : DISC 2
S704 : DISC 1
S705 : AUTO FADER
S706 : DELETE
S708 : PROGRAM
S721 : COMPU TIME FADE
S722 : HI - LITE
S723 : DISC 3
S724 : DISC 4
S725 : ADLC
S726 : MUSIC TYPE
S727 : DISC 5
S728 : DISC 6
S729 : PAUSE
S730 : REPEAT
S731 : STOP
S732 : TIME
S733 : PLAY ►
S734 : RANDOM
S735 : ◀◀◀
S736 : ▶▶▶

SWITCH BOARD ASSEMBLY

S801 : POWER

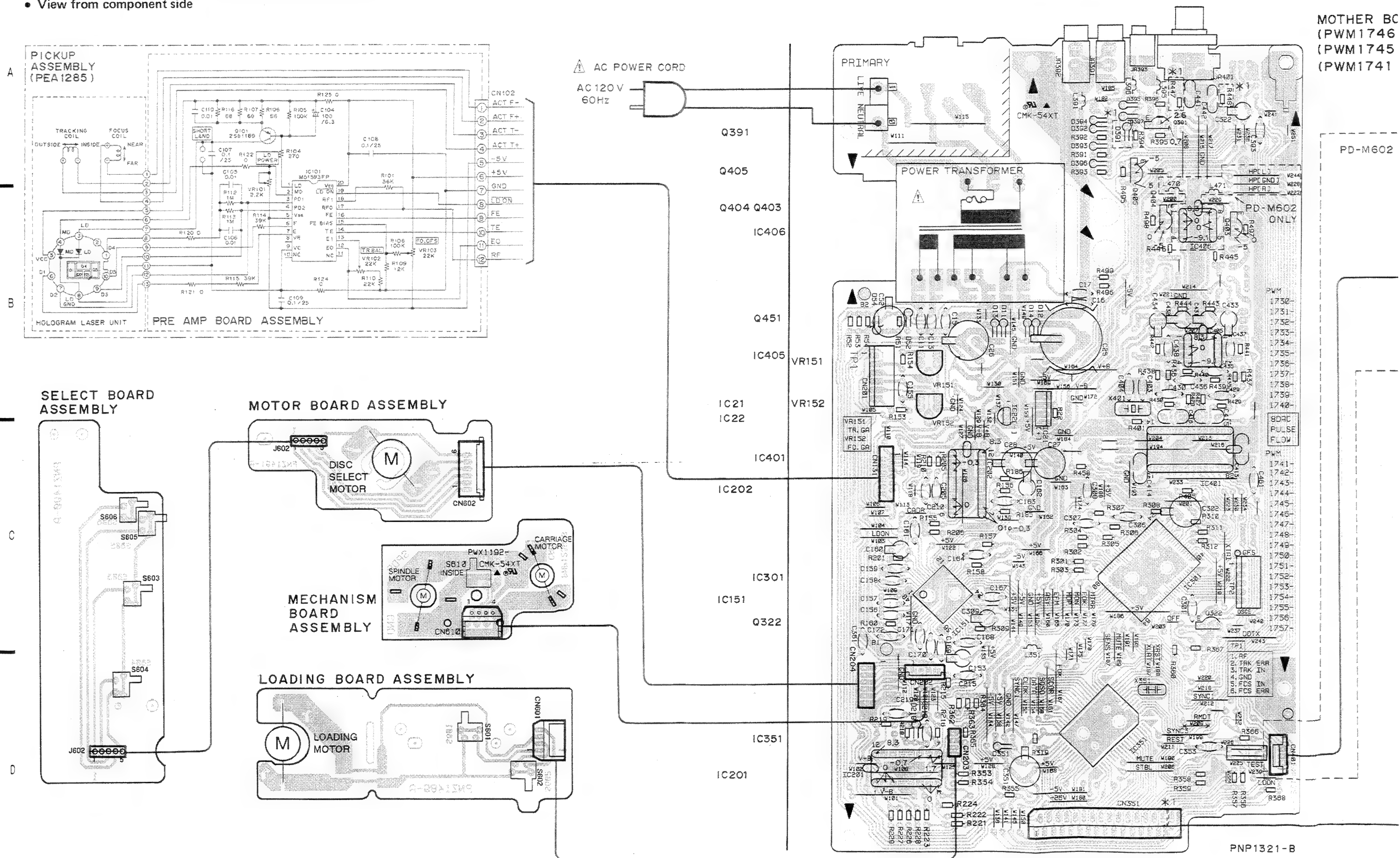
IC401:PD2026B



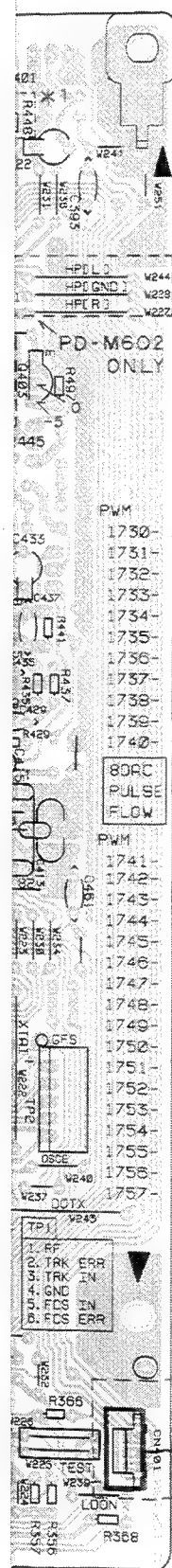


6. PCB CONNECTION DIAGRAM

• View from component side

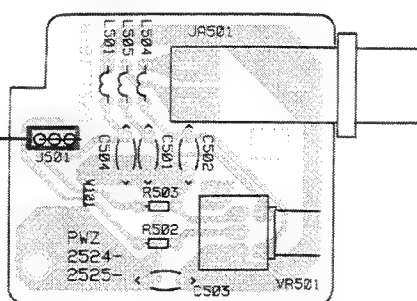


MOTHER BOARD ASSEMBLY
(PWM1746:PD-M602)
(PWM1745:PD-M552)
(PWM1741:PD-M502)

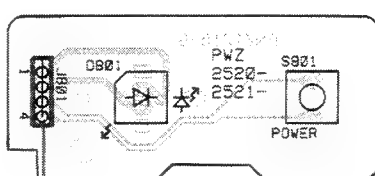


PD-M602 ONLY

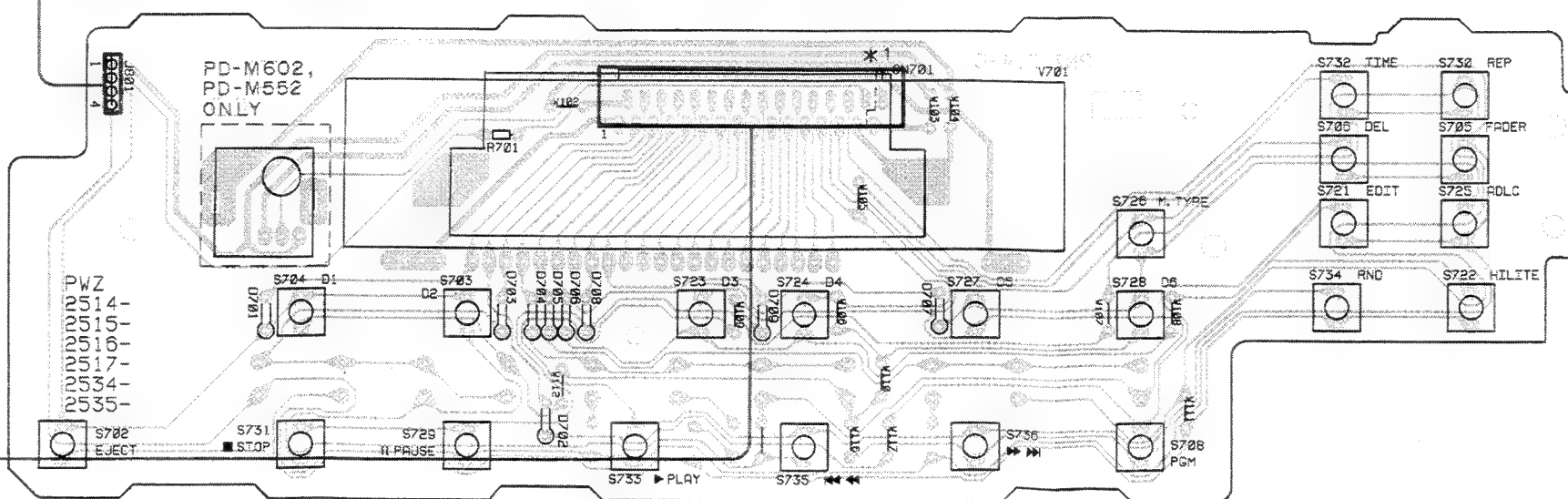
HEADPHONE BOARD ASSEMBLY



SWITCH BOARD ASSEMBLY



FUNCTION BOARD ASSEMBLY
(PWZ2516: PD-M602, PD-M552)
(PWZ2514: PD-M502)

10151 (CXA13720)

Pin No.	Voltage (V)	Pin No.	Voltage (V)
1	0	25	5.0
2	0	26	0
3	0	27	5.0
4	0	28	0
5	-0.3	29	0
6	0	30	-5.0
7	0.2	31	2.5
8	0	32	2.5
9	0	33	5.0
10	5.0	34	-1.5
11	0	35	-1.7
12	0	36	5.0
13	0	37	-0.7
14	0 to 0.1	38	-1.6
15	0	39	0
16	-4.0	40	0.8
17	1.3	41	-5.0
18	0	42	0
19	-5.0	43	0
20	5.0	44	0
21	5.0	45	0
22	5.0	46	0
23	5.0	47	0
24	5.0	48	0




1C301 (CXD2500BQ)

Pin No.	Voltage [V]	Pin No.	Voltage [V]	Pin No.	Voltage [V]	Pin No.	Voltage [V]
1	5. 0	21	0	41	2. 5	61	0
2	2. 1	22	2. 5	42	5. 0	62	2. 1
3	5. 0	23	5. 0	43	2. 5	63	0
4	2. 6	24	2. 5	44	0	64	0
5	2. 2	25	0. 2	45	5. 0	65	0
6	5. 0	26	0	46	4. 4	66	1.3 to 4.6
7	0	27	2. 5	47	0	67	5. 0
8	5. 0	28	0	48	0	68	0
9	0	29	0	49	0 to 6.3	69	2.1 to 3.6
10	0	30	0	50	1. 2	70	5. 0
11	2. 1	31	1.3 to 2.2	51	1. 2	71	5. 0
12	0	32	2. 5	52	0	72	5. 0
13	1. 0	33	5. 0	53	2. 5	73	5. 0
14	0.3 to 1.3	34	2. 5	54	2. 5	74	5. 0
15	0	35	2. 5	55	0	75	5. 0
16	2. 0	36	2. 5	56	2. 9	76	0
17	0	37	2. 5	57	2. 5	77	5. 0
18	2. 5	38	2. 5	58	2. 5	78	5. 0
19	2. 4	39	0	59	0	79	5. 0
20	2. 4	40	5. 0	60	0	80	0

✱

	D391	R447	R448	CN351 CN701
PD-M602	USED	USED	USED	32P
PD-M552	USED	JUMPER	JUMPER	32P
PD-M502	NOT USE	JUMPER	JUMPER	30P

P.C.B. pattern diagram indication	Corresponding part symbol	Part name	P.C.B. pattern diagram indication	Corresponding part symbol	Part name
		Transistor			Ceramic capacitor
		FET			Mylar capacitor
		Diode			Styrol capacitor
		Diode			Electrolytic capacitor (Non polarized)
		Diode			Electrolytic capacitor (Noiseless)
		Diode			Electrolytic capacitor (Polarized)
		Diode			Electrolytic capacitor (Polarized)
		LED			Power capacitor
		Varactor			Semi-fixed resistor
		Tact switch			Resistor array
		Inductor			Resistor
		Coil			Resonator
		Transformer			Thermistor
		Filter			

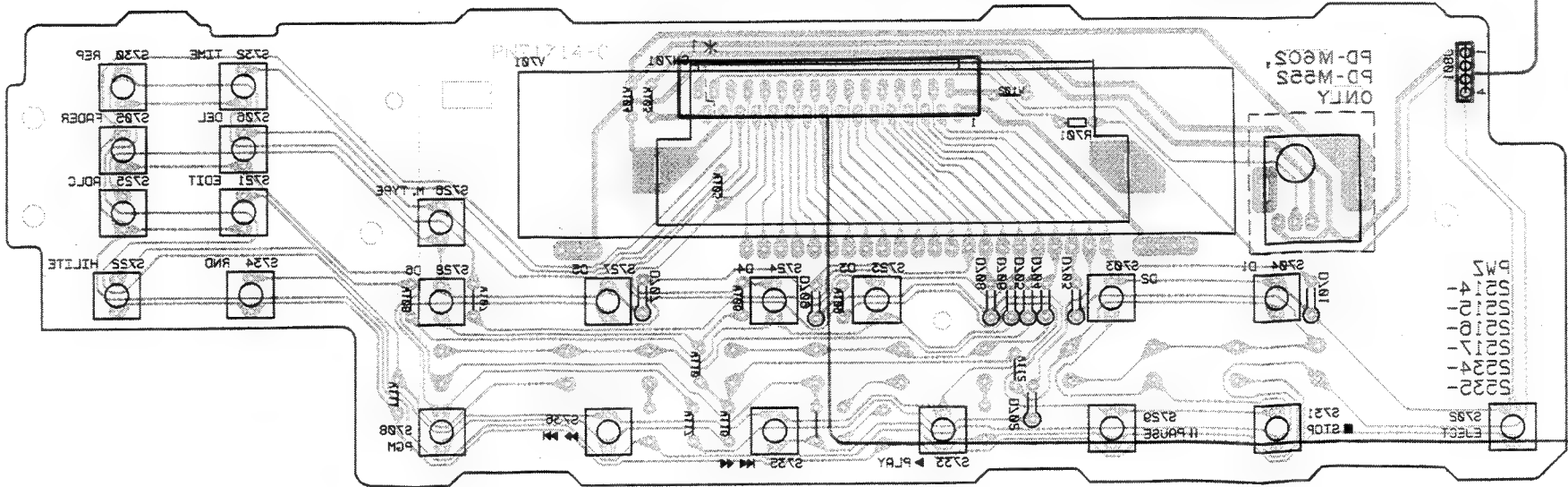
1. This P.C.B. connection diagram is viewed from the parts mounted side.
2. The parts which have been mounted on the board can be replaced with those shown with the corresponding wiring symbols listed in the above Table.
3. The capacitor terminal marked with  shows negative terminal.
4. The diode marked with  shows cathode side.
5. The transistor terminal marked with  shows emitter.

10351 (PD4458A)

Pin No.	Voltage [V]	Pin No.	Voltage [V]	Pin No.	Voltage [V]	Pin No.	Voltage [V]
1	5. 0	17	-3 to -22	33	5. 0	49	0
2	-22. 0	18	-26. 0	34	2.5 to 4.7	50	5. 0
3	-22. 0	19	-5. 0	35	5. 0	51	0
4	-22. 0	20	-3 to -22	36	0	52	5. 0
5	-22. 0	21	-3 to -22	37	5. 0	53	5. 0
6	-22. 0	22	-3 to -22	38	5. 0	54	5. 0
7	-22. 0	23	-3 to -22	39	0	55	0
8	-22. 0	24	-3 to -22	40	0	56	2. 5
9	-22. 0	25	-3 to -22	41	0	57	2. 5
10	-22. 0	26	5. 0	42	0	58	0
11	-25. 0	27	-3 to -22	43	0	59	0
12	5. 0	28	-3 to -22	44	0	60	5. 0
13	5. 0	29	-3 to -22	45	0	61	0
14	0	30	-3 to -22	46	0	62	0
15	0	31	5. 0	47	0	63	0
16	-3 to -22	32	5. 0	48	0	64	0

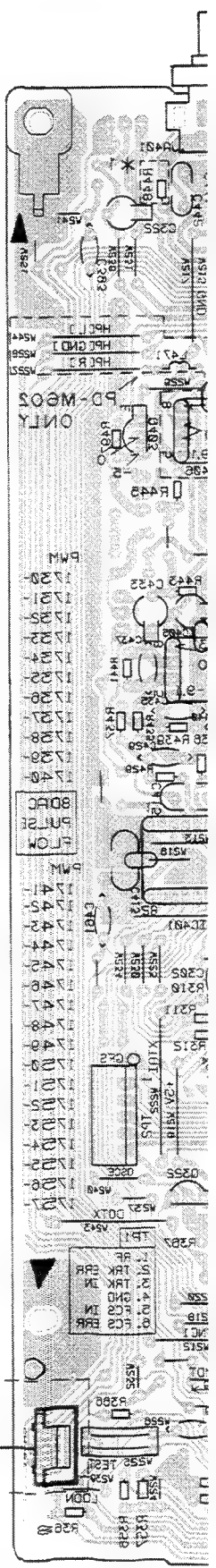
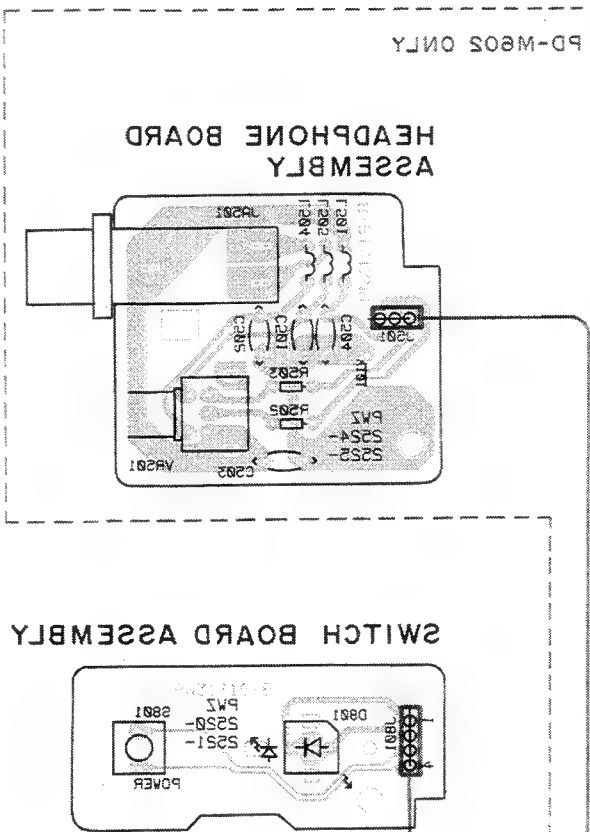
Pin	No.	Voltage [V]	Pin	No.	Voltage [V]	Pin	No.	Voltage [V]	Pin	No.	Voltage [V]
1	0	1.7	-3 to -5.5	33	0	3.4	3.2 to 4.1	20	46	0	0
2	0	1.8	-2.8 to 0	34	0	3.5	0	21	20	0	0
3	0	1.9	-2.0	35	0	3.6	0	22	20	0	0
4	0	2.0	-1.9 to -5.5	36	0	3.7	0	23	20	0	0
5	0	2.1	-3 to -5.5	37	0	3.8	0	24	20	0	0
6	0	2.2	-1 to -5.5	38	0	4.0	0	25	20	0	0
7	0	2.3	-3 to -5.5	39	0	4.1	0	26	20	0	0
8	0	2.4	-1 to -5.5	40	0	4.2	0	27	20	0	0
9	0	2.5	-3 to -5.5	41	0	4.3	0	28	20	0	0
10	0	2.6	-2.0	42	0	4.4	0	29	20	0	0
11	0	2.7	-3 to -5.5	43	0	4.5	0	30	20	0	0
12	0	2.8	-3 to -5.5	44	0	4.6	0	31	20	0	0
13	0	2.9	-3 to -5.5	45	0	4.7	0	32	20	0	0
14	0	3.0	-3 to -5.5	46	0	4.8	0	33	20	0	0
15	0	3.1	2.0	47	0	4.9	0	34	20	0	0
16	-3 to -5.5	3.2	2.0	48	0	5.0	0	35	20	0	0

			D391	R447	R448	CIN51 CIN701
PD-M60S	USED	USED	USED	USED	32P	
PD-M55S	USED	JUMPER	JUMPER	JUMPER	32P	
PD-M50S	NOT USE	JUMPER	JUMPER	JUMPER	30P	



No.	Pin	Pin	No.	Pin	No.	Pin
24	2.0	48	0	2.0	23	2.0
23	2.0	47	0	2.0	22	2.0
22	2.0	46	0	2.0	21	2.0
21	2.0	45	0	2.0	20	2.0
20	2.0	44	0	2.0	19	-2.0
19	-2.0	43	0	18	0	42
18	0	42	0	17	1.3	41
17	1.3	41	-2.0	16	-4.0	40
16	-4.0	40	0	15	0	39
15	0	39	0	14	0.16	38
14	0.16	38	-1.6	13	0	37
13	0	37	-0.1	12	2.0	36
12	2.0	36	-1.1	11	2.0	35
11	2.0	35	0	10	2.0	34
10	2.0	34	0	9	0	33
9	0	33	2.2	8	0	32
8	0	32	0.2	7	0.2	31
7	0.2	31	2.2	6	0	30
6	0	30	0	5	0	29
5	0	29	0	4	0	28
4	0	28	0	3	0	27
3	0	27	0	2	0	26
2	0	26	2.0	1	0	25

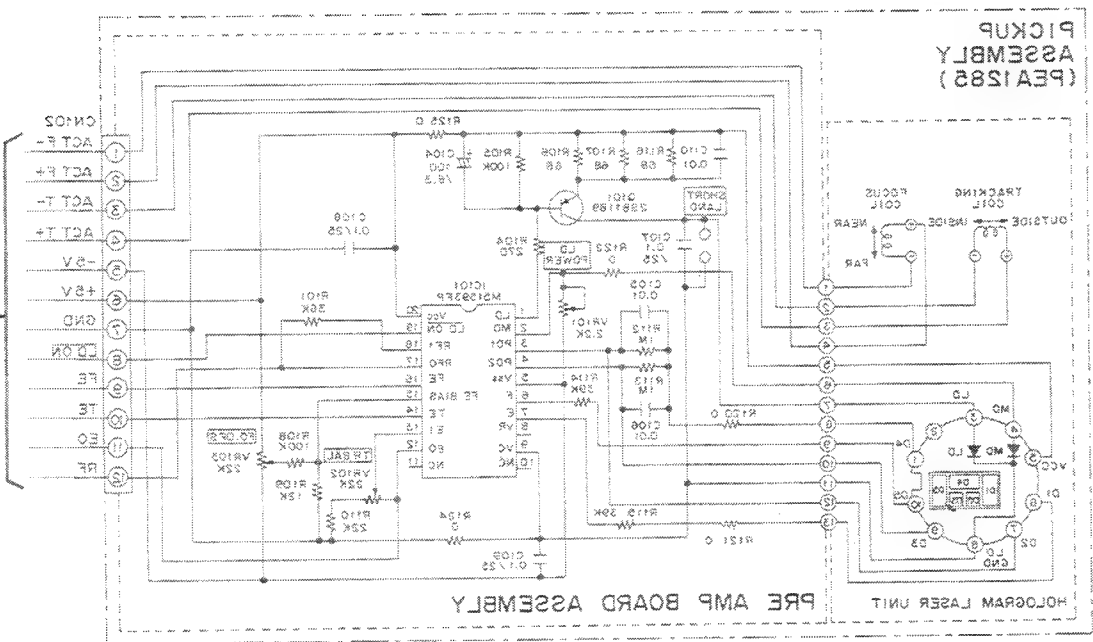
Pin No.	Pin Voltage (V)	Pin No.	Pin Voltage (V)	Pin No.	Pin Voltage (V)	Pin No.	Pin Voltage (V)
1	2.0	7	2.1	13	2.4	19	2.0
2	2.1	8	2.0	14	2.3	20	2.0
3	2.0	9	0	15	2.2	21	2.0
4	2.0	10	0	16	2.1	22	2.0
5	2.2	11	2.1	17	2.0	23	2.0
6	2.0	12	2.0	18	2.2	24	2.0
7	0	13	2.1	19	2.0	25	2.0
8	2.0	14	2.3	20	2.0	26	2.0
9	0	15	2.2	21	2.0	27	2.0
10	0	16	2.1	22	2.0	28	2.0
11	2.1	17	2.0	23	2.0	29	2.0
12	0	18	2.2	24	2.0	30	2.0
13	2.4	19	2.0	25	2.0		
14	2.3	20	2.0				
15	2.2	21	2.0				
16	2.1	22	2.0				
17	2.0	23	2.0				
18	2.2	24	2.0				
19	2.0	25	2.0				
20	2.0	26	2.0				



(PWW1741:PD-M505)
(PWW1745:PD-M525)
(PWW1746:PD-M605)
MOTHER BOARD ASSEMBLY

6. PCB CONNECTION DIAGRAM

• View from soldering side



Mark	No.	Description	Part No.
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FUNCTION BOARD ASSEMBLY

SEMICONDUCTORS

D701, D702, D706-D709	1SS254
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SWITCHES

S702-S706, S708, S721-S736	PSG1006
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RESISTORS

ALL RESISTORS	RD1/6PM□□□J
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OTHERS

CN701 CONNECTOR(32P)	HLEM32R-1
V701 FL INDICATOR TUBE	PEL1072
REMOTE CONTROL SENSOR	SBX1610-51

SWITCH BOARD ASSEMBLY

SEMICONDUCTORS

D801	PCX1019
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SWITCHES

S801	PSG1006
------	---------

HEADPHONE BOARD ASSEMBLY

COILS

L501, L504, L505	LAU010K
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CAPACTORS

C501, C502	CKCYF103Z50
C503	CKCYF473Z50

RESISTORS

VR501	PCS1003
OTHER RESISTORS	RD1/6PM□□□J

OTHERS

JA501 HEADPHONE JACK	RKN1002
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MECHANISM BOARD ASSEMBLY

SWITCHES

S610	DSG1016
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LOADING BOARD ASSEMBLY

SWITCHES

S601, S602	DSG1016
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MOTOR BOARD ASSEMBLY

Motor board assembly has no service part.

SELECT BOARD ASSEMBLY

SWITCHES

S604-S606	DSG1016
S603	PSG1010

8. ADJUSTMENTS

8.1. Adjustment Methods

If a disc player is adjusted incorrectly or inadequately, it may malfunction or not work at all even though there is nothing at all wrong with the pickup or the circuitry. Adjust correctly following the adjustment procedure.

● Adjustment Items/Verification Items and Order

If the specified values cannot be obtained or no adjustment is possible by performing the verifications or adjustments described in steps 1 – 4, the pickup block may be defective.

Step	Item	Test Point	Adjustment Location
1	Focus offset verification	TP1, Pin 6 (FCS. ERR)	None
2	Tracking error balance verification	TP1, Pin 2 (TRK. ERR)	None
3	Pickup radial/tangential direction tilt adjustment	TP1, Pin 1 (RF)	Radial tilt adjustment screw, Tangential tilt adjustment screw
4	RF level verification	TP1, Pin 1 (RF)	None
5	Focus servo loop gain adjustment	TP1, Pin 5 (FCS. IN) TP1, Pin 6 (FCS. ERR)	VR152 (FCS. GAN)
6	Tracking servo loop gain adjustment	TP1, Pin 3 (TRK. IN) TP1, Pin 2 (TRK. ERR)	VR151 (TRK. GAN)

● Abbreviation table

FCS. ERR	:Focus Error
TRK. ERR	:Tracking Error
FCS GAN	:Focus Gain
TRK GAN	:Tracking Gain
FCS. IN	:Focus In
TRK. IN	:Tracking In

● Measuring Instruments and Tools

1. Dual trace oscilloscope (10:1 probe)
2. Low-frequency oscillator
3. Test disc (YEDS-7)
4. Low pass filter ($39\text{k}\Omega$ $\pm 0.001\ \mu\text{F}$)
5. Resistor (100 $\text{k}\Omega$)
6. Standard tools

● Test Point and Adjustment Variable Resistor Positions

MOTHER BOARD ASSEMBLY

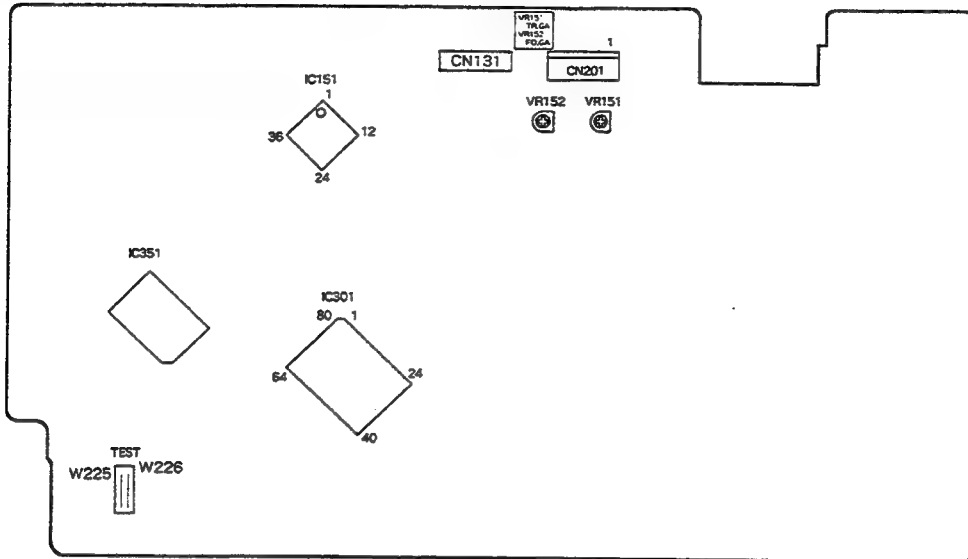


Figure 1. Adjustment Locations

● Notes

1. Use a 10:1 probe for the oscilloscope.
2. All the knob positions (settings) for the oscilloscope in the adjustment procedures are for when a 10:1 probe is used.

● Test Mode

These models have a test mode so that the adjustments and checks required for service can be carried out easily. When these models are in test mode, the keys on the front panel work differently from normal. Adjustments and checks can be carried out by operating these keys with the correct procedure. For these models, all adjustments are carried out in test mode.

[Setting these models to test mode]

How to set this model into test mode.

1. Unplug the power cord from the AC socket.
2. Short the test mode jumper wires. (See Figure 1.)
3. Plug the power cord back into the AC socket.

When the test mode is set correctly, the display is different from what it usually is when the power is turned on. If the display is still the same as usual, test mode has not been set correctly, so repeat Steps 1 – 3.

[Release from test mode]

Here is the procedure for releasing the test mode:

1. Press the STOP key and stop all operations.
2. Unplug the power cord from the AC socket.

[Operations of the keys in test mode]

Code	Key Name	Function in Test Mode	Explanation
	PGM (PROGRAM)	Focus servo close	<p>The laser diode is lit up and the focus actuator is lifted up, then lowered slowly and the focus servo is closed at the point where the objective lens is focused on the disc. With the player in this state, if you lightly rotate the stopped disc by hand, you can hear the sound the focus servo.</p> <p>If you can hear this sound, the focus servo is operating correctly. If you press this key with no disc mounted, the laser diode lights up, the focus actuator is pulled up, then the actuator is lowered and raised three times and returned to its original position.</p>
▷	PLAY	Spindle servo ON	<p>Starts the spindle motor in the clockwise direction and when the disc rotation reaches the prescribed speed (about 500 rpm at the inner periphery), sets the spindle servo in a closed loop.</p> <p>Be careful. Pressing this key when there is no disc mounted makes the spindle motor run at the maximum speed.</p> <p>If the focus servo does not go correctly into a closed loop or the laser light shines on the mirror section at the outermost periphery of the disc, the same symptom is occurred.</p>
⏸	PAUSE	Tracking servo close/open	<p>Pressing this key when the focus servo and spindle servo are operating correctly in closed loops puts the tracking servo into a closed loop, displays the track number being played back and the elapsed time on the front panel, and outputs the playback signal.</p> <p>If the elapsed time is not displayed or not counted correctly or the audio is not played back correctly, it may be that the laser is shining on the section with no sound recorded at the outer edge of the disc, that something is out of adjustment, or that there is some other problem.</p> <p>This key is a toggle key and open/close the tracking servo alternately. This key has no effect if no disc is mounted.</p>

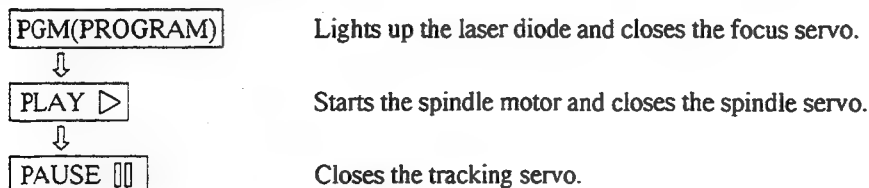
Code	Key Name	Function in Test Mode	Explanation
⏮ ⏪	TRACK / MANUAL SEARCH REV	Carriage reverse (inwards)	Moves the pickup position toward the inner diameter of the disc. When this key is pressed with the tracking servo in a closed loop, the tracking servo automatically goes into an open loop. Since the motor does not automatically stop at the mechanical end point in test mode, be careful with this operation.
⏭ ⏩	TRACK / MANUAL SEARCH FWD	Carriage forward (outwards)	Moves the pickup position toward the outer diameter of the disc. When this key is pressed with the tracking servo in a closed loop, the tracking servo automatically goes into an open loop. Since the motor does not automatically stop at the mechanical end point in test mode, be careful with this operation.
□	STOP	Stop	Initializes and the disc rotation stops. The pickup and disc remain where they are when this key is pressed.
△	EJECT	CD magazine eject	Stores Disc 1 in the CD magazine, then ejects the CD magazine. However, even though the CD magazine is ejected, the pickup does not return to the park position. Even if the CD magazine is mounted again, the pickup remains where it is.

Note : When inserting the magazine, disc 1 of the magazine is loaded automatically.

[How to play back a disc in test mode]

In test mode, since the servos operate independently, playing back a disc requires that you operate the keys in the correct order to close the servos.

Here is the key operation sequence for playing back a disc in test mode.



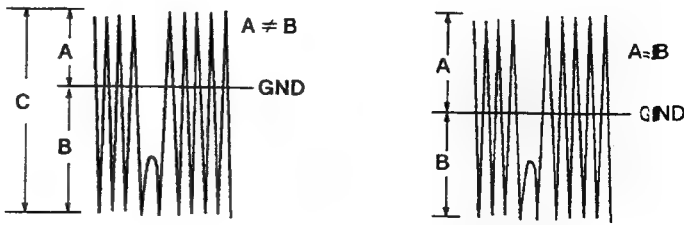
Wait at least 2-3 seconds between each of these operations.

1. Focus Offset Verification

● Objective	Verify the DC offset for the focus error amp.		
● Symptom when out of adjustment	The model does not focus in and the RF signal is dirty.		
● Measurement instrument connections	Connect the oscilloscope to TP1, Pin 6 (FCS. ERR)	● Player state	Test mode, stopped (just the Power switch on)
	[Settings] 5 mV/division 10 ms/division DC mode	● Adjustment location	None
		● Disc	None needed
[Procedure]			
Verify the DC voltage at TP1, Pin 6 (FCS. ERR) is 0 ± 50 mV.			

Note : If the specified values cannot be obtained or no adjustment is possible by performing the verifications or adjustments described in adjustment items 1 – 4, the pickup block may be defective.

2. Tracking Error Balance Verification

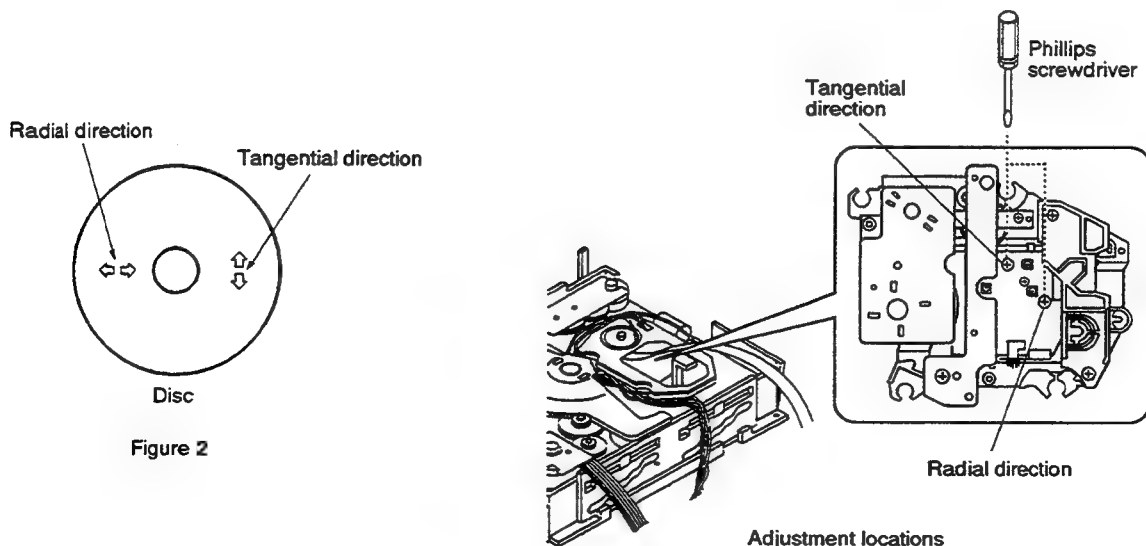
● Objective	To verify that there is no variation in the sensitivity of the tracking photo diode.		
● Symptom when out of adjustment	Play does not start or track search is impossible.		
● Measurement instrument connections	Connect the oscilloscope to TP1, Pin 2 (TRK. ERR). This connection may be via a low pass filter.	● Player state	Test mode, focus and spindle servos closed and tracking servo open
	[Settings] 50 mV/division 5 ms/division DC mode	● Adjustment location	None
		● Disc	YEDS-7
[Procedure]			
<ol style="list-style-type: none"> 1. Move the pickup to midway across the disc (R=35 mm) with the TRACK/MANUAL SEARCH FWD $\triangleright \triangleright$ • $\triangleright \triangleright$ or REV $\triangleleft \triangleleft$ • $\triangleleft \triangleleft$ key. 2. Press the PGM (PROGRAM) key, then the PLAY \triangleright key in that order to close the focus servo then the spindle servo. 3. Line up the bright line (ground) at the center of the oscilloscope screen and put the oscilloscope into DC mode. 4. Supposing that the positive amplitude of the tracking error signal at TP1, pin 2 (TRK ERR) is (A) and the negative amplitude is (B), the following expression is satisfied. 			
When $A \geq B$, $\frac{A-B}{C} \times \frac{1}{2} \leq 0.1$ When $A < B$, $\frac{B-A}{C} \times \frac{1}{2} \leq 0.1$			
		When there is a DC component When there is no DC component	

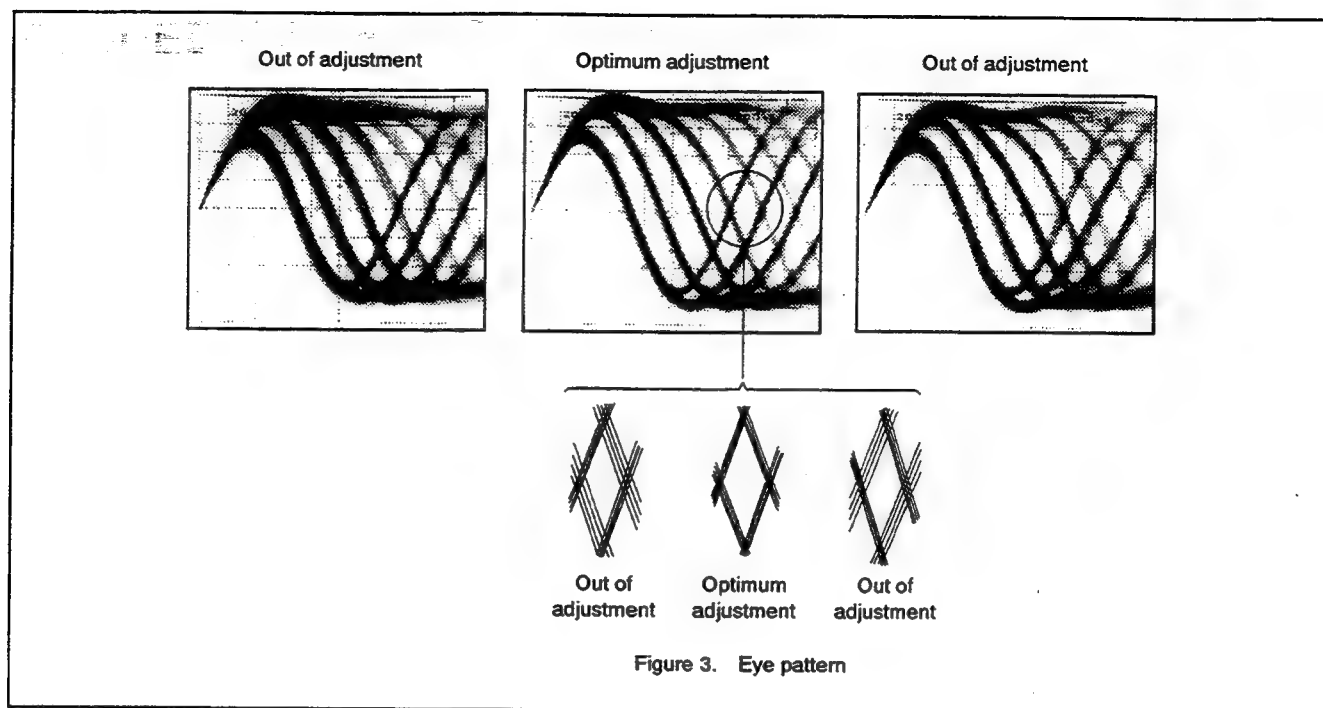
3. Pickup Radial/Tangential Tilt Adjustment

● Objective	To adjust the angle of the pickup relative to the disc so that the laser beams are shone straight down into the disc for the best read out of the RF signals.		
● Symptom when out of adjustment	Sound broken; some discs can be played but not others.		
● Measurement instrument connections	Connect the oscilloscope to TP1, Pin 1 (RF). [Settings] 20 mV/division 200 ns/division AC mode	● Player state ● Adjustment location ● Disc	Test mode, play Pickup radial tilt adjustment screw and tangential tilt adjustment screw YEDS-7

[Procedure]

1. Press the TRACK/MANUAL SEARCH FWD \gg • \gg or REV \ll • \ll key to move the pickup to halfway across the disc (R=35mm).
Press the PGM (PROGRAM) key, the PLAY \triangleright key, then the PAUSE \square key in that order to close the respective servos and put the player into play mode.
 2. First, adjust the radial tilt adjustment screw with a Phillips screwdriver so that the eye pattern (the diamond shape at the center of the RF signal) can be seen the most clearly.
 3. Next, adjust the tangential tilt adjustment screw with a Phillips screwdriver so that the eye pattern (the diamond shape at the center of the RF signal) can be seen the most clearly (Figure 3).
 4. Adjust the radial tilt adjustment screw and the tangential tilt adjustment screw again so that the eye pattern can be seen the most clearly. As necessary, adjust the two screws alternately so that the eye pattern can be seen the most clearly.
 5. When the adjustment is completed, lock the radial and tangential adjustment screw.
- Note: Radial and tangential mean the directions relative to the disc shown in Figure 2.





4. RF Level Verification

● Objective	To verify the playback RF signal amplitude		
● Symptom when out of adjustment	No play or no search		
● Measurement instrument connections	Connect the oscilloscope to TP1, Pin 1 (RF).	● Player state	Test mode, play
	[Settings] 50 mV/division 10 ms/division AC mode	● Adjustment location	None
		● Disc	YEDS-7
[Procedure] <ol style="list-style-type: none"> 1. Move the pickup to midway across the disc (R=35 mm) with the TRACK/MANUAL SEARCH FWD $\triangleright \triangleright$ • $\triangleright \triangleright$ or REV $\triangleleft \triangleleft$ • $\triangleleft \triangleleft$ key, then press the PGM (PROGRAM) key, the PLAY \triangleright key, then the PAUSE $\square \square$ key in that order to close the respective servos and put the player into play mode. 2. Verify the RF signal amplitude is $1.2 \text{ V}_{p-p} \pm 0.2 \text{ V}$. 			

5. Focus Servo Loop Gain Adjustment

● Objective	To optimize the focus servo loop gain.		
● Symptom when out of adjustment	Playback does not start or focus actuator noisy.		
● Measurement instrument connections	See figure 4. [Settings] CH1 20 mV/division X-Y mode	● Player state	Test mode, play
		● Adjustment location	VR152 (FCS. GAN)
		● Disc	YEDS-7

[Procedure]

1. Set the AF generator output to 1.2 kHz and 1 Vp-p.
2. Press the TRACK / MANUAL SEARCH FWD >>> · >>> or REV <<< · <<< key to move the pickup to halfway across the disc (R=35 mm), then press the PGM (PROGRAM) key, the PLAY > key, then the PAUSE || key in that order to close the corresponding servos and put the player into play mode.
3. Adjust VR152 (FCS. GAN) so that the Lissajous waveform is symmetrical about the X axis and the Y axis.

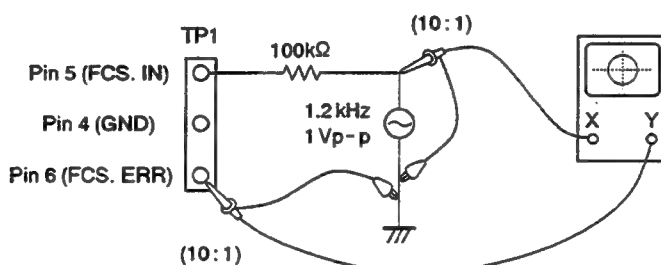
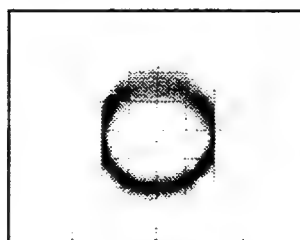


Figure 4

Focus Gain Adjustment



Higher gain



Optimum gain



Lower gain

6. Tracking Servo Loop Gain Adjustment

● Objective	To optimize the tracking servo loop gain.		
● Symptom when out of adjustment	Playback does not start, during searches the actuator is noisy, or tracks are skipped.		
● Measurement instrument connections	See Figure 5.	● Player state	Test mode, play
	[Settings] CH1 CH2 50 mV/division 20 mV/division X-Y mode	● Adjustment location	VR151 (TRK. GAN)
		● Disc	YEDS-7

[Procedure]

1. Set the AF generator output to 1.2 kHz and 2 Vp-p.
2. Press the TRACK/MANUAL SEARCH FWD $\triangleright\triangleright$ • $\triangleright\triangleright$ or REV $\triangleleft\triangleleft$ • $\triangleleft\triangleleft$ key to move the pickup to halfway across the disc (R=35 mm), then press the PGM (PROGRAM) key, the PLAY \triangleright key, then the PAUSE $\square\square$ key in that order to close the corresponding servos and put the player into play mode.
3. Adjust VR151 (TRK. GAN) so that the Lissajous waveform is symmetrical about the X axis and the Y axis.

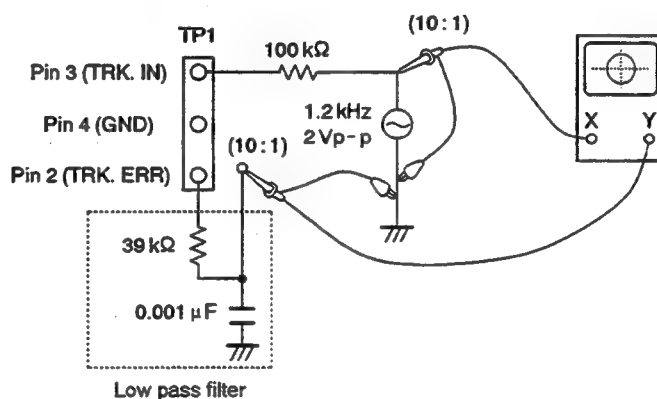
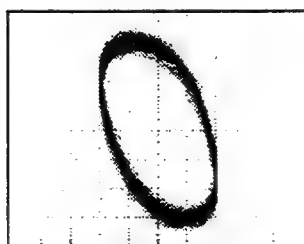


Figure 5

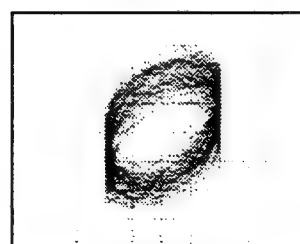
Tracking Gain Adjustment



Higher gain



Optimum gain



Lower gain

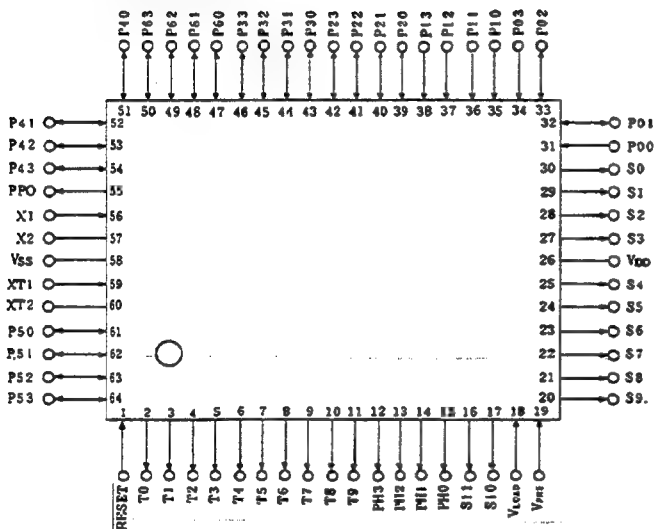
9. IC INFORMATION

- The information shown in the list is basic information and may not correspond exactly to that shown in the schematic diagrams.

■ PD4458A (IC351)

• System Control (Top view)

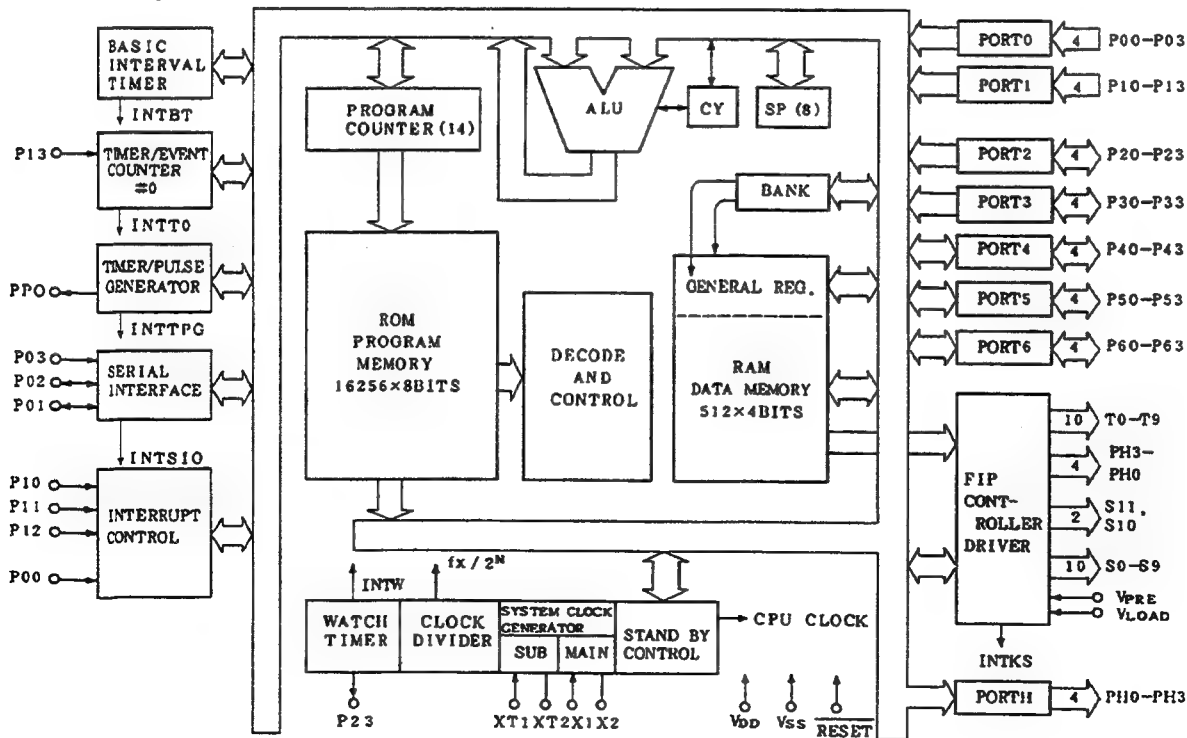
• Pin Arrangement



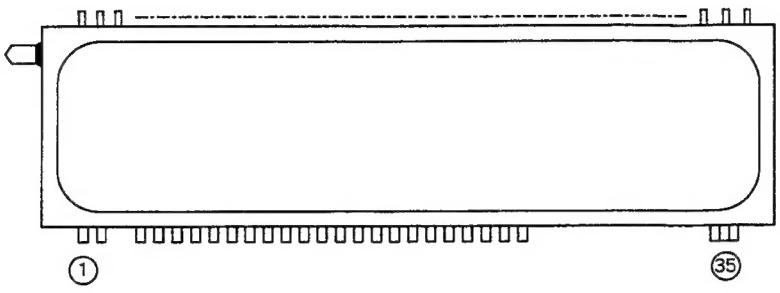
• Pin Function

No.	Pin Name	Function
1	RESET	Reset input.
2-11	T0-T9	Digit output.
12-15	PH3-PH0	Port H.
16,17	S11,S10	Segment output.
18	VLOAD	Power supply terminal for FIP driver.
19	VPRE	Power supply terminal for FIP driver.
20-25	S9-S4	Segment output.
26	VDD	+ Power supply terminal.
27-30	S3-S0	Segment output.
31-34	P00-P03	Port 0.
35-38	P10-P13	Port 1.
39-42	P20-P23	Port 2.
43-46	P30-P33	Port 3.
47-50	P60-P63	Port 6.
51-54	P40-P43	Port 4.
55	PPO	Pulse output.
56,57	X1,X2	Clock oscillation terminal of Main system.
58	VSS	Ground
59,60	XT1,XT2	Clock oscillation terminal of Sub system.
61-64	P50-P53	Port 5.

• Block Diagram



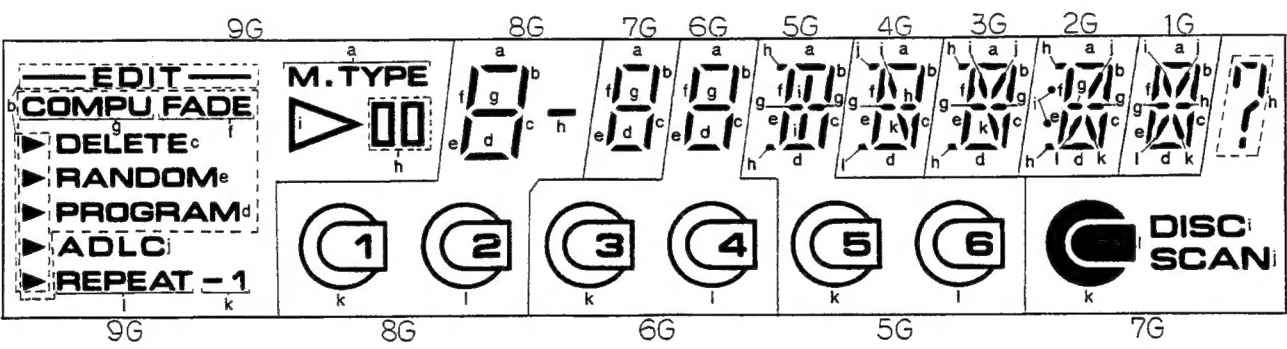
■ PEL1072 (V701)



PIN CONNECTION

TERMINAL NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
ELECTRODE	F1	F1	NP	P (e)	P (f)	P (g)	P (h)	P (i)	P (b)	P (c)	P (d)	P (i)	P (j)	P (k)	P (l)	NC	9G	8G		
TERMINAL NO.				19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
ELECTRODE				7G	6G	5G	4G	3G	2G	1G	NP	NP	NP	NP	NP	NP	NP	NP	F2	F2

Notes F: Filament NP: No Pin
G: Grid NC: No Connection
P: Anode



10. FOR PD-M602/KUXJ, KUXJS, KC, KCXJ, PD-M552/KU, KUXJ, KUXJS, PD-M502/KU, KUXJ, KUXJS, KC AND KCXJ TYPES

CONTRAST OF MISCELLANEOUS PARTS

NOTES:

- Parts marked by "NSP" are generally unavailable because they are not in our Master Spare Parts List.
- The Δ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- Parts marked by "⊙" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.

PD-M602/KUXJ, KUXJS, KC, KCXJ, PD-M552/KU, KUXJ, KUXJS, PD-M502/KU, KUXJ, KUXJS, KC, KCXJ and PD-M602/KU have the same construction except for the following:

Mark	Symbol & Description	Part No.													Remarks
		PD-M602/ KU type	PD-M602/ KUXJ type	PD-M602/ KUXJS type	PD-M602/ KC type	PD-M602/ KCXJ type	PD-M552/ KU type	PD-M552/ KUXJ type	PD-M552/ KUXJS type	PD-M502/ KU type	PD-M502/ KUXJ type	PD-M502/ KUXJS type	PD-M502/ KC type	PD-M502/ KCXJ type	
NSP	Mother board assembly	PWM1746	PWM1746	PWM1746	PWM1746	PWM1746	PWM1745	PWM1745	PWM1745	PWM1741	PWM1741	PWM1741	PWM1741	PWM1741	
	Sub board assembly	PWX1268	PWX1268	PWX1268	PWX1268	PWX1268	PWX1267	PWX1267	PWX1267	PWX1265	PWX1265	PWX1265	PWX1265	PWX1265	
	Function board assembly	PWZ2516	PWZ2516	PWZ2516	PWZ2516	PWZ2516	PWZ2516	PWZ2516	PWZ2516	PWZ2514	PWZ2514	PWZ2514	PWZ2514	PWZ2514	
NSP	Headphone board assembly	PWZ2524	PWZ2524	PWZ2524	PWZ2524	PWZ2524	.....	.....	.....	.....	.....	.....	.....	.....
Δ	Power cord with plug	PDG1015	PDG1015	PDG1015	RDG1010	RDG1010	PDG1015	PDG1015	PDG1015	PDG1015	PDG1015	PDG1015	RDG1010	RDG1010	
Δ	Strain relief	CM - 22C	CM - 22C	CM - 22C	CM - 22	CM - 22	CM - 22C	CM - 22C	CM - 22C	CM - 22C	CM - 22C	CM - 22C	CM - 22	CM - 22	
	32P F.F.C/30V (J701)	PDD1125	PDD1125	PDD1125	PDD1125	PDD1125	PDD1125	PDD1125	PDD1125	.....	.....	.....	.....	.....
	30P F.F.C/30V (J701)	.....	.....	.....	.....	.....	.....	.....	.....	PDD1126	PDD1126	PDD1126	PDD1126	PDD1126	
	Remote control unit	PWW1068	PWW1068	PWW1068	PWW1068	PWW1068	PWW1068	PWW1068	PWW1068	.....	.....	.....	.....	.....
	Battery cover	PZN1010	PZN1010	PZN1010	PZN1010	PZN1010	PZN1010	PZN1010	PZN1010	.....	.....	.....	.....	.....
NSP	Battery (R03 AAA)	VEM - 022	VEM - 022	VEM - 022	VEM - 022	VEM - 022	VEM - 022	VEM - 022	VEM - 022	.....	.....	.....	.....	.....
	Function panel assembly	PEA1265	PEA1265	PEA1265	PEA1265	PEA1265	PEA1274	PEA1274	PEA1274	PEA1264	PEA1264	PEA1264	PEA1264	PEA1264	
	Function panel	PNW2250	PNW2250	PNW2250	PNW2250	PNW2250	PNW2275	PNW2275	PNW2275	PNW2249	PNW2249	PNW2249	PNW2249	PNW2249	
	Function button	PAC1717	PAC1717	PAC1717	PAC1717	PAC1717	PAC1716	PAC1716	PAC1716	PAC1716	PAC1716	PAC1716	PAC1716	PAC1716	
	Knob (Headphone)	PAC1707	PAC1707	PAC1707	PAC1707	PAC1707	.....	.....	.....	.....	.....	.....	.....	.....
NSP	Display window	PAM1607	PAM1607	PAM1607	PAM1607	PAM1607	PAM1601	PAM1601	PAM1601	PAM1600	PAM1600	PAM1600	PAM1600	PAM1600	
	Rear base	PNA1915	PNA1941	PNA2008	PNA1940	PNA1942	PNA1938	PNA1939	PNA2011	PNA1914	PNA1935	PNA2007	PNA1932	PNA1936	
	Insulator	PNW1912	PNW1912	PNW1912	PNW1912	PNW1912	PNW1912	PNW1912	PNW1912	.....	.....	.....	.....	.....
	Leg assembly	.....	.....	.....	.....	.....	.....	.....	.....	PEA1293	.....	.....	PEA1293	.....	*1
NSP	Leg	.....	.....	.....	.....	.....	.....	.....	.....	PNW1323	.....	.....	PNW1323	.....	*1
	Stopper	.....	.....	.....	.....	.....	.....	.....	.....	PNM1070	.....	.....	PNM1070	.....	*1
	Insulator assembly	.....	.....	.....	.....	.....	.....	.....	.....	DXA1490	DXA1490	DXA1490	.....	DXA1490	
	CD packing case	PHG1869	PHG1917	PHG1944	PHG1924	PHG1918	PHG1884	PHG1916	PHG1947	PHG1868	PHG1913	PHG1943	PHG1922	PHG1914	
	Operating instructions (French)	.....	.....	.....	PRC1053	PRC1053	.....	.....	.....	.....	.....	.....	PRC1053	PRC1053	

Note *1 : Refer to page 6.

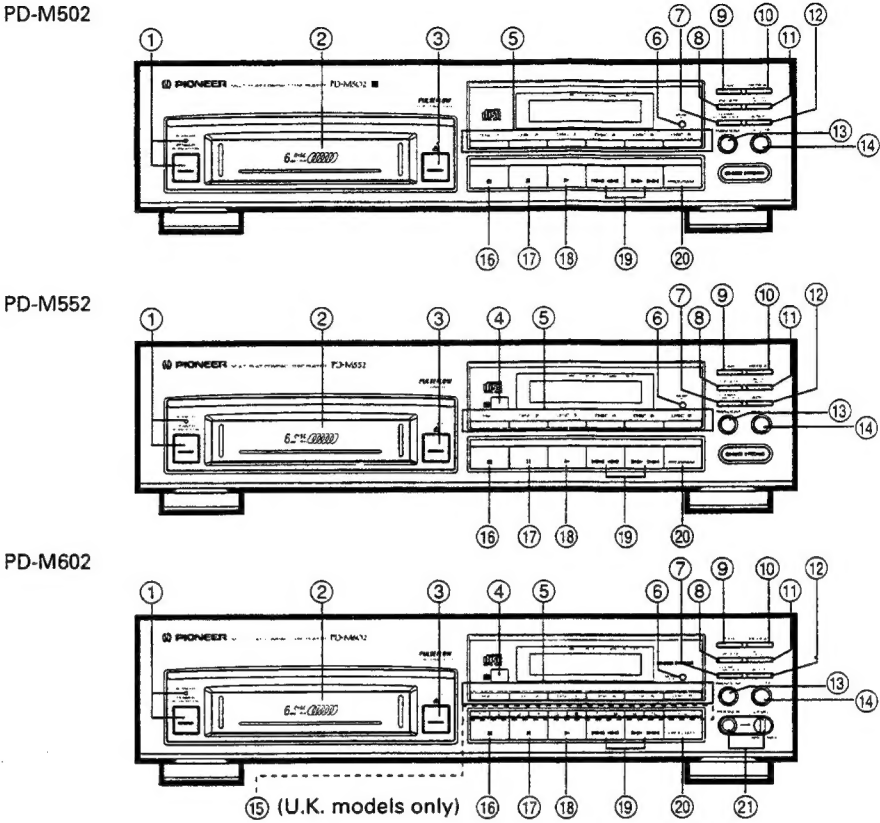
MOTHER BOARD ASSEMBLY
PWM1745, PWM1741 and PWM1746 have the same construction except for the following:

Mark	Symbol & Description	Part No.			Remarks
		PWM1746	PWM1745	PWM1741	
	IC405 IC406 D391 C433, C434 (22/25V) C433, C434	NJM4565D - D BA15218 1SS254 PCH1107	NJM4558D - D 1SS254 CEAS220M25	NJM4558D - D CEAS220M25	
	R445, R446 R447, R448 L470, L471 CN351 (32P FFC connector) CN351 (30P FFC connector)	RD1/6PM471J RD1/6PM471J LAU010K HLEM32S - 1	RD1/6PM102J HLEM32S - 1	RD1/6PM102J HLEM30S - 1	
NSP	CN401	52147 - 0310	.....	.....

FUNCTION BOARD ASSEMBLY
PWZ2514 and PWZ2516 have the same construction except for the following:

Mark	Symbol & Description	Part No.		Remarks
		PWZ2516	PWZ2514	
	CN701 (32P FFC connector) CN701 (30P FFC connector)	HLEM32R - 1 .....	..... HLEM30R - 1	
	Remote sensor	SBX1610 - 51	.....

11. PANEL FACILITIES



- ① POWER STANDBY/ON switch and STANDBY indicator

② Magazine insertion slot

③ EJECT button (▲)

④ Remote sensor (Except for PD-M502)
Receives the signal from the remote control unit.
• The PD-M502 is not equipped with the remote sensor.

⑤ Disc number buttons (DISC 1~DISC 6)

⑥ MUSIC TYPE button

⑦ COMPU/TIME FADE button

⑧ DELETE button

⑨ TIME button

⑩ REPEAT button

⑪ AUTO FADER button

⑫ ADLC (Automatic Digital Level Controller) button
- ⑬ RANDOM play button

⑭ HI-LITE scan button

⑮ Digit buttons (1~10, >10) (PD-M602 [U.K. model] only)

⑯ Stop button (■)

⑰ Pause button (⏸)

⑱ Play button (▶)

⑲ Track/Manual search buttons (◀◀/▶▶)

⑳ PROGRAM button

㉑ Headphones jack (PHONES) and headphones volume control (PHONES LEVEL) (PD-M602 only)

12. SPECIFICATIONS

General

Type Compact disc digital audio system

Power requirements

U.K. and Australian models AC 220-240 V, 50/60 Hz

U.S. and Canadian models AC 120 V, 60 Hz

Other models AC 110-127 V/220-240 V (switchable),
50/60 Hz

Power consumption

U.K., Australian and other models 13 W

U.S. and Canadian models 12 W

Operating temperature +5°C~+35°C
(+41°F~+95°F)

Weight 3.8 kg (8 lb, 6 oz)

External dimensions 420 (W) x 299 (D) x 105 (H) mm
16-9/16 (W) x 11-12/16 (D) x 4-1/8 (H) in

Audio section

Frequency response 2 Hz-20 kHz

S/N ratio

PD-M602(U.K. model) 102 dB or more (EIAJ)

Other models 98 dB or more (EIAJ)

Dynamic range 96 dB or more (EIAJ)

Harmonic distortion 0.003% or less (EIAJ)

Output voltage 2.0 V

Wow and flutter Limit of measurement
(±0.001% W. PEAK) or less (EIAJ)

Channels 2-channel (stereo)

Output terminal

Audio line output

Headphone jack with volume control (PD-M602 only)

Control input/output jacks (PD-M502/PD-M552: all models, PD-M602: U.S. and Canadian models only)


CD-DECK SYNCHRO jack

Accessories

- Remote control unit (Except for PD-M502) 1
- Size AAA/R03/dry batteries
(Except for PD-M502) 2
- Six-compact-disc magazine 1
- Control cord (PD-M502/PD-M552: all models, PD-M602
: U.S. and Canadian models only) 1
- Output cord 1
- Operating instructions 1

NOTE:

Specifications and design subject to possible modification without notice, due to improvements.

The Magazine Type Multi-Play CD Players with
 mark and the Magazines with the same
mark are compatible for 5-inch (12 cm) discs.